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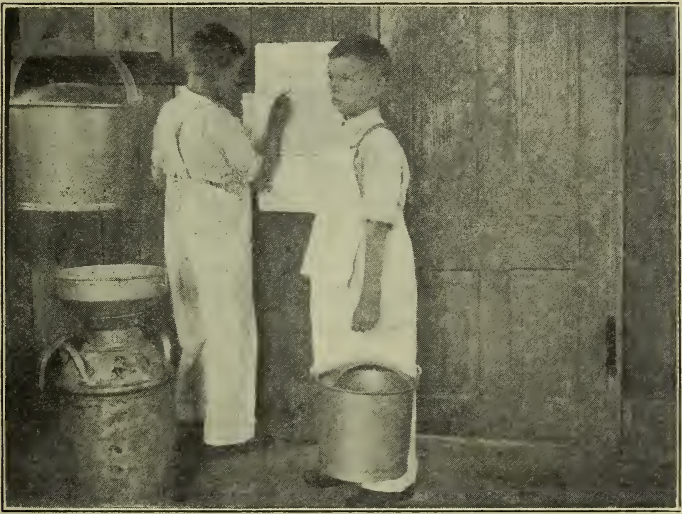
Profitable Dairy Herds Thru Cow Testing

A. C. Ragsdale[1]



Enthusiastic dairymen on the farm of a Jackson County Cow Testing Association member.

The cow testing association enables farmers to apply the principles of better agriculture directly to their business. They thus become interested and desire to know more about present practices for successful management of a dairy. The cow testing association carries this information to the dairyman in one of the most practical and economical ways. It proves its value in his own business and under his own conditions. This is shown by the rapid progress made in communities where cow testing associations are in operation.

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[1] E. A. Ikenberry, county agent, assisted the author in compiling much of the Jackson County Cow Testing Association data and in securing the illustrations used herein.

The cow testing association is the simplest, surest, and cheapest method for the rapid improvement of dairy cows. It affords the average dairyman an economical means of obtaining a record of how much each cow produces and what it costs. Most dairymen realize that this information is of great value, but will not take sufficient time to keep the records themselves. It is true that such records require regularity in testing and weighing of milk and feed, and a systematic form of keeping the data. This is undoubtedly the reason why so many dairymen have failed to keep such records even when they fully appreciate their value. This difficulty is eliminated by the cow testing association, which furnishes a more economical way of obtaining such records than if each dairyman undertook to keep his own.

WHAT A COW TESTING ASSOCIATION IS

A cow testing association is a group of farmers, usually 26, who agree to cooperate for the purpose of improving their dairy herds. They form an association and hire a man whose duty it is to weigh and test the milk, and to keep a detailed record of the production of each cow in their herds together with the cost of production. This man, called the tester, spends one day every month on the farm of each member where he weighs and tests the milk from each cow. From this data he calculates the amount of milk and fat produced during the month and its value at the market price. The tester also weighs and records the amount and kind of feed given each cow, computes its value and estimates the total cost of feed for the month. When this amount has been charged against the value of the milk and fat produced for that month, the owner is able to determine the profit or loss on each cow in his herd, the amount returned for each dollar he expended for feed, and the cost of producing a pound of fat and 100 pounds of milk.

It is also the duty of the tester to assist in selecting feeds and in figuring the most profitable rations, to offer suggestions on breeding, management, and other phases of the business as deemed advisable by the attitude of the member. He will not make suggestions nor advocate changes for any farm, unless he feels that they will be welcomed by the owner. The tester comes to the farm in the afternoon

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with his outfit. He with the owner weighs and estimates the feed given each cow, and at milking time they weigh, and take a sample of, the milk from each cow. The next morning these same operations are repeated, the Babcock test is applied to the mixed sample representing the morning and evening milk of each cow, the outfit is washed, and the necessary computations are made and recorded in the member's herd book. When this is completed the tester goes on to the farm of the next member.

It is the duty of the members to keep as accurate an account of the milk produced and feed consumed between the visits of the tester as is practical under ordinary farm conditions, so that they may give reliable information to the tester.

MISSOURI COW TESTING ASSOCIATIONS

Missouri now has four cow testing associations. The Jackson County Association, organized May 1, 1914, by E. A. Ikenberry, the county agent, is the oldest association in the state. It is now in its fourth year, and its continued growth and success have been due both to the excellent results and to the careful supervision of the county agent. During the last year cow testing associations have been organized in Pettis county, Johnson county, and Marion county. In each of these counties the county agent has assisted in starting the organization and is taking an active part in supervising the work.

A study of the results obtained in the Jackson County Cow Testing Association brings out clearly many of the benefits of cow testing work.

WHAT A COW TESTING ASSOCIATION DOES

1. IT DETECTS UNPROFITABLE COWS

A dairyman does not know whether or not he has unprofitable cows in his herd until he has had their milk weighed and tested and an accurate record kept of the amount and cost of feed eaten by each cow. Table 1, compiled from Jackson county records, shows facts concerning the herd which testing and record keeping will bring out.

A study of results in Table 1 shows that 28 cows were sold as unprofitable the first year, 30 the second year, and 50 the third year.

TABLE 1.—COWS TESTED IN JACKSON COUNTY ASSOCIATION

	1914-15	1915-16	1916-17
Cows starting years' work	342	373	417
Cows completing full year's work	185	215	246
Cows sold because unprofitable	28	30	50
Cows died during the year	5	3	7
Cows sold because of abortion or failure to breed	10	9	12
Cows condemned for tuberculosis	0	5	14
Cows sold at public or private sale	20	26	32
Cows discontinued because of sale of herds or loss of members	94	85	56
Cows entered after year's work had begun	154	145	146
Different cows tested during the year	496	518	563

Good blood, full development before breeding, good care and liberal feeding made this cow the heaviest producer in the Jackson County Association. She produced 10475.2 pounds of milk, containing 567 pounds of butterfat, approximately five times as much as the lowest producer.

The fact that more cows were sold as unprofitable each succeeding year is doubtless due to the steady advance in feed prices and the fact that the farmers realized more than ever before the necessity of culling out the poorer cows. Some cows that may have been profitable the first year of the association were no longer profitable with the advance in the price of feed during the later part of the second and the third year.

This means that during the third year about one cow in eight which started the year's work was sold as an unprofitable producer.

In addition twelve cows were sold on account of abortion or failure to breed. Since such results were obtained in Jackson county, one of the best dairy communities in the state, it is evident that the proportion of unprofitable cows in the state as a whole is much larger.

There are approximately 850,000 dairy cows in Missouri. If records were kept on these, at least 150,000 probably would be found unprofitable. An accurate record of the production and feed cost of each cow is absolutely the only way to detect these unprofitable ones.

2. IT HELPS TO BUILD HIGHER PRODUCING HERDS

The production records of all cows which completed a year's work in the Jackson County Association, during its first three years of work, show a steady increase in milk and fat production. Table 2 also shows a steady increase in the number of high producing cows and a corresponding decrease in the number of low producing cows for each succeeding year.

TABLE 2.—SUMMARY OF PRODUCTION RECORDS OF JACKSON COUNTY FOR THREE YEARS

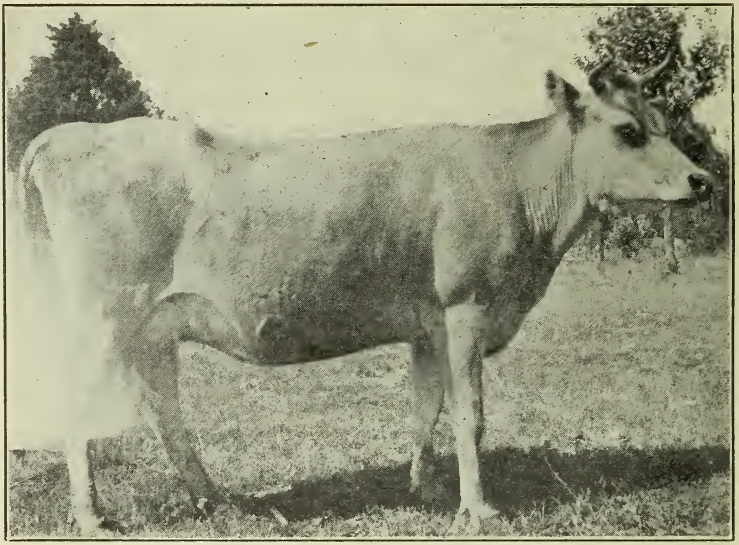
	No. of cows			Average lbs. of milk			Average lbs. butterfat		
	1914-15	15-16	16-17	1914-15	15-16	16-17	1914-15	15-16	16-17
Average of association	185	215	246	5407.0	5984.3	6223.8	254.6	274.5	288.7
Cows producing over 400 lbs. fat	6	19	31	8730.6	8348.0	8760.0	416.5	464.5	452.3
Cows producing 300 to 400 lbs. fat	47	54	80	7355.0	7108.8	6956.6	339.4	337.4	338.8
Cows producing 200 to 300 lbs. fat	83	112	112	5297.6	5384.8	5730.9	224.0	251.9	259.0
Cows producing 100 to 200 lbs. fat	47	29	23	3642.0	3786.3	3904.1	168.6	165.8	173.5
Cows producing under 100 lbs. fat	2	1	0	1525.0	2088.0		78.1	94.1	

CONTINUED TESTING OF THE INDIVIDUAL HERD PAYS

The record of the herds of all members who have remained in this association for the last three years are shown in Table 3.

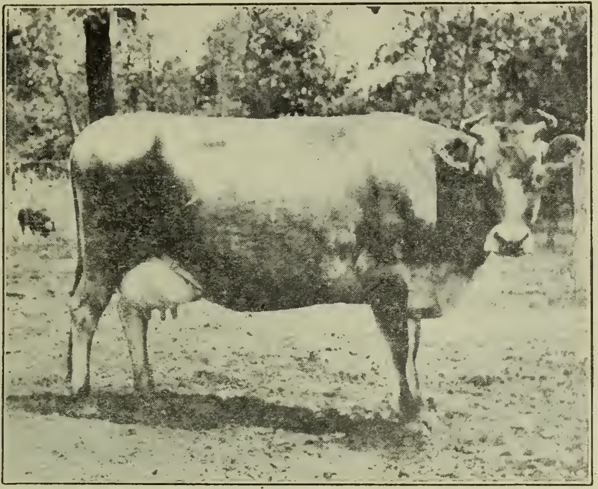
TABLE 3.—RECORDS OF HERDS IN ASSOCIATION THREE YEARS

Year	No. of cows	Pounds milk	Pounds fat	Price per lb.	Value of product	Feed cost	Profit over feed cost	Return for $1
1914-15	119	4598.5	229.5	50c.	$114.75	$60.29	$53.46	$1.93
1915-16	143	5512.8	271.7	51c.	138.57	65.02	73.55	2.16
1916-17	131	6204.4	310.2	53c.	164.41	64.05	100.36	2.56
Increase		1605.9	80.7	03c.	49.66	3.76	46.90	.63



Underfeeding made this cow the lowest producer in the Jackson County Association. She is of excellent breeding, and a good individual.

These six Jackson county dairymen were able to increase milk production 1605.9 pounds, and butterfat production 80.7 pounds for each cow over the average production of their herds the first year. The increased profit for each cow was $46.90. It is not known what the butterfat production was for 1913-14, but it is safe to assume that it did not exceed 175 pounds of fat per cow since the improvement is usually at least somewhat more the first year than any succeeding year. This means the butterfat production was increased 135 pounds in three years. At 53 cents a pound for butterfat, the average price received by association members during the third year, this increase was worth $71.55 for each cow. The return for $1 spent for feed was 63 cents greater the third year than the first. Assuming that the average production of each cow was 175 pounds of fat for the year previous to the one in which cow testing association work began, the return for $1 spent for feed would be at least 90 cents more at the end of three years of cow testing association work than at the beginning. With such results before him no dairyman can doubt the value of the work.



This cow returned as much profit, feed cost alone considered, as 14 cows like the least profitable one in the Jackson County Association. If labor and overhead charges were considered the difference would be more striking. She produced 10029.7 pounds of milk containing 502.2 pounds of butterfat at a feed cost of 12.56 cents per pound fat and gave a return of $4.22 for each $1.00 spent for feed.

The cost of labor, barn room and other overhead expenses is practically the same for a low producing as for a high producing herd, and the cost of feed for the low producing herd is far more, in proportion to what they produce, than for the high producing herd. The man with a poor herd can not take the same pride and pleasure in his work as the one who has a good herd and knows what each of his cows is doing.

3. IT IS A HELP IN MORE ECONOMICAL FEEDING

Every dairyman who pays the high prices for feed stuffs today is asking—will the cows pay for it? The only way to feed a herd economically is to feed each cow the amount she can use most profitably. In the cow testing association the tester weighs the feed and milk, and tests the milk for butterfat once each month, thus giving the owner a record which enables him to feed each cow according to her ability to pay for the feed.

In spite of the increasing cost of feed, Table 3 shows that 131 cows were fed at a slightly lower feed cost per cow in 1916-17 than 143 cows were fed during the previous year and at only a slightly increased feed cost per cow over 1914-15. At the same time there was a constant increase in milk and butterfat production.

The cow testing association shows the return of each cow for $1 spent for feed.

TABLE 4.—JACKSON COUNTY ASSOCIATION FEED COSTS AND PROFITS FOR THIRD YEAR

Ten most profitable cows				Ten least profitable cows			
Cow	Lbs. fat produced	Cost of feed	Return for $1	Cow	Lbs. fat produced	Cost of feed	Return for $1
1	502.2	$63.12	$4.22	1	140.3	$60.20	$1.23
2	408.9	56.23	3.85	2	190.7	79.92	1.26
3	400.9	58.44	3.63	3	195.7	74.13	1.39
4	427.9	64.30	3.52	4	163.2	59.53	1.45
5	477.8	75.68	3.34	5	199.4	72.87	1.45
6	411.9	68.03	3.20	6	198.9	70.50	1.49
7	430.1	73.21	3.11	7	186.3	65.62	1.51
8	467.5	81.68	3.04	8	186.7	64.76	1.52
9	445.2	78.79	2.99	9	197.3	63.83	1.63
10	567.0	101.22	2.96	10	157.2	49.72	1.67
Average	453.9	72.07	3.39	Average	181.6	66.11	1.46

It will be noted that the feed cost of the poorer cows was almost as great as that for the heavier producing cows; that for every dollar expended for feed, the ten best cows returned $3.39 against a return of $1.46 from the poorer cows, and further that the average butterfat production of the ten most profitable cows was 453.9 pounds against 181.6 pounds for the ten poorest cows.

Feed is the greatest item of expense in producing milk, and as a result cows are too frequently underfed. Underfeeding is one of the greatest mistakes of the average dairyman. The heavy producer must have more feed than the low producer, but both must have a properly balanced ration to return the most profit. The tester employed should be a man trained and experienced in dairying. This, together with the knowledge which he attains from observing closely the results of feeding methods in the herds of the association, puts him in position to help each member figure out the most economically balanced ration for his herd. It is a very common experience for each member to save more in feed alone, during the first six months, than the testing costs him for the entire year.

Registration papers alone don't make a good cow. This cow is lacking in breeding and individuality, so that she does not produce profitably. These factors coupled with abortion made her the fifth poorest producer in the Jackson County Association.

4. IT TEACHES PROPER CARE AND MANAGEMENT

Many of the most unprofitable cows are naturally unable to convert feed into milk at a profit, owing to hereditary factors. Others are unprofitable because they are not given a fair chance.

A study of the ten lowest producing cows in the Jackson County Association brings out some interesting information on this subject.

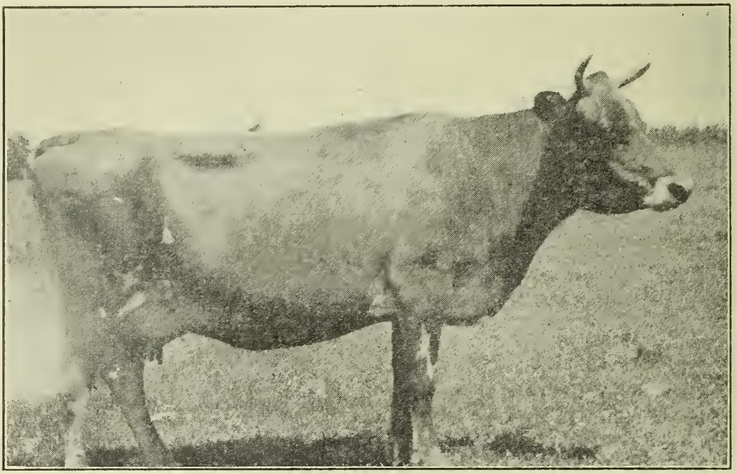
WHY COWS ARE POOR

Cow 1 produced 2264.8 pounds milk containing 117.7 pounds fat. She was only a two-year-old heifer and aborted.

Cow 2 produced 2695 pounds of milk containing 131.5 pounds of fat. This cow had a strong tendency to dry up after a short milking period. She was a poor individual without the ability to produce profitably.

Cow 3 produced 3742.6 pounds of milk containing 140.3 pounds of fat. She had been fresh three months before testing for the year began and did not freshen again during the test. She was only two years old.

Cow 4 produced 3334 pounds of milk containing 147.9 pounds of fat. She was in milk only 276 days and apparently did not have great ability, but was underfed so that she did not have opportunity to produce up to her capacity.



Because of abortion and failure to get in calf, this cow was ninth lowest producer in the Jackson County Association, with 163 pounds of fat. She freshened normally after being dry 84 days and promises to produce more than 400 pounds of fat during the year.

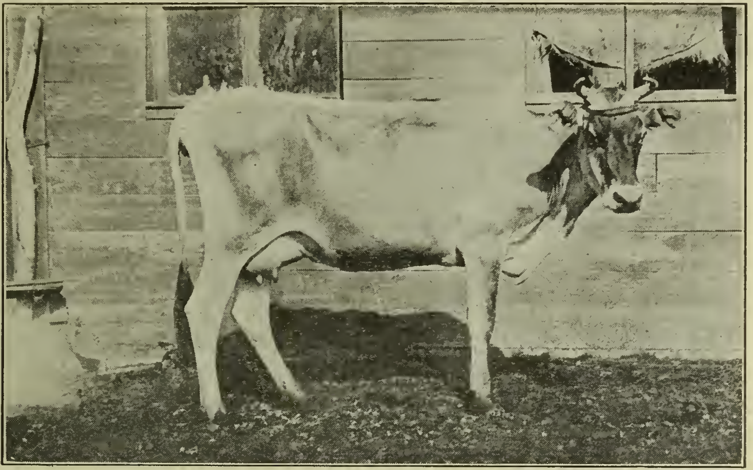
Cow 5 produced 2999.4 pounds of milk containing 155.6 pounds of fat. This cow had aborted with her last two calves. Altho a cow of poor individuality, she did not have a fair chance to do as well as she was capable.

Cow 6 produced 3814.7 pounds of milk containing 157.2 pounds of fat. Because of failure to get in calf at the proper time she stood dry too long during the year. She was a good type of cow and had every indication of being able to produce heavily, but did not prove to be a persistent milker.

Cow 7 produced 3679.2 pounds of milk containing 157.4 pounds of fat. She was a good appearing cow but not a persistent milker. This animal had been a poor producer during the two previous years and evidently lacked ability to produce at a profit.

Cow 8 produced 3348 pounds of milk containing 162.4 pounds of fat. This cow was a good appearing individual but was underfed so that she did not have a fair chance to produce up to her ability.

Cow 9 produced 3140 pounds of milk containing 163.2 pounds of fat. This cow had aborted with her last calf and since then had been in milk one and one-half years previous to the beginning of this test. She freshened normally during the last month of this year's test, after being dry 84 days, and all indications are that she will be an extraordinarily heavy producer this year.



Lack of care, poor management and underfeeding made this cow the eighth lowest producer in the Jackson County Association. She is a good appearing individual of excellent breeding.

Cow 10 produced 3903 pounds of milk containing 174.8 pounds of fat. She was in milk 304 days of the year. Altho apparently not a cow of great ability she was underfed and did not have opportunity to produce as well as she was capable.

Cows may be poor because: (1) they lack breeding and individuality; (2) they are underfed; (3) they were bred too young; (4) they lack care and are poorly managed; (5) because of disease, especially abortion; (6) or because they are not persistent milkers. Any of these factors or a combination of several of them is the general reason for low producers.

To increase the production of herds, it is evident that records must be kept, and those cows which do not have the ability to produce profitably must be eliminated to give the others a fair chance thru proper feed, care, and management. Experience has taught that few farmers will keep these records themselves and that the most practical means of getting them is to organize a cow testing association and employ a tester.

Improvement in dairy cattle increases the actual value per cow, decreases the cost of production and increases the profit to the farmer.

WHAT MAKES A GOOD COW

TABLE 5.—TEN HEAVIEST PRODUCING COWS IN JACKSON COUNTY ASSOCIATION THIRD YEAR

Cow	Pounds milk	Pounds fat	Value product at 53c per pound fat	Feed cost	Profit over feed cost	Return for $1
1	10475.2	567.0	$300.51	$101.22	$199.29	$2.97
2	10730.7	565.5	299.72	103.14	196.58	2.91
3	9094.3	511.2	270.94	98.00	172.94	2.74
4	10029.7	502.2	266.17	63.12	203.05	4.22
5	11003.7	501.8	265.95	96.89	169.06	2.74
6	10901.2	498.0	263.94	95.74	168.20	2.76
7	9375.6	477.8	253.23	75.68	177.55	3.35
8	8612.3	467.5	247.78	81.68	166.10	3.08
9	10091.6	466.6	247.30	95.29	152.01	2.60
10	8938.6	465.3	246.61	99.73	146.88	2.47
Average	9925.29	502.29	266.22	91.05	175.17	2.92

The ten best cows in the Jackson County Association were registered animals. They were sired by some of the best bulls of the breed which they represent and they were out of good producing dams. Nine out of these ten cows were direct descendants from the same foundation herd. All were fed liberally and cared for properly. These cows were large, strong, and healthy.

The following are factors that go to make good cows: (1) good breeding (good sires); (2) proper development of the heifers; (3) not breeding heifers too young; (4) liberal and proper feeding; (5) accurate records; (6) good care; (7) healthy cows.

5. IT TESTS THE BULL, TOO

Several of the heaviest producing herds in the Jackson County Association have been developed mainly from the same foundation stock. This foundation stock is largely descended from two bulls.

Herd 1 was the second heaviest producing herd the first year, with 42 cows which averaged 304.8 pounds of butterfat each; the second heaviest producing herd the second year with 42 cows which averaged 340.17 pounds of butterfat; the heaviest producing herd the third year with 50 cows which averaged 370.8 pounds of butterfat. This herd was built up largely from this foundation stock.

Not being a persistent milker made this cow the sixth lowest producer in the Jackson County Association, altho she is a heavy producer when fresh.

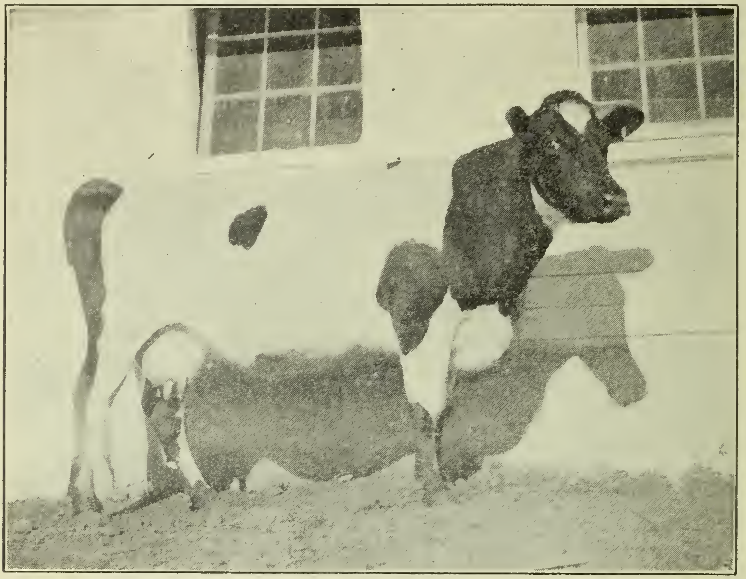
Herd 2 was the heaviest producing herd in the association the second year, with 9 cows which averaged 342 pounds of butterfat. It also was descended from this foundation stock.

Herd 3 was the second heaviest producing herd in the association the third year, with 26 cows which averaged 325.1 pounds of butterfat. This herd came from the same foundation stock.

Other excellent herds in that section of the state are being started with this same breeding stock. Bulls which produce stock of this kind are a great financial asset to any community. The bull is half the herd or more. Even tho a good price is paid for him, unless records are kept, nobody can tell whether he increases or decreases the production of a herd. If he increases production he should not be sacrificed, but kept in the community. If the owner can not use him longer, neighbors will be anxious to pay a big price for him. If he is lowering the production of the herd, the sooner he is sent to the butcher the better. A complete record of the herd soon determines the value of a bull.

6. IT INCREASES THE SELLING PRICE OF COWS AND THEIR OFFSPRING

No progressive dairyman today will buy a bull from a cow that has not an authentic record of production. The man with accurate herd records showing the production of each individual in his herd adds at least 15 per cent to the value of that herd. One member of the Jackson County Association, who sold his entire herd at public auction in November, 1915, and used the record each cow had made in the cow testing association, gives the following statement:



A good sire, proper development, good care and careful feeding made this the heaviest milk producing cow in the Association—with 11,082 pounds containing 418.7 pounds fat.

"At the time of my sale my herd consisted of 7 registered cows, 14 grade cows, and 4 grade heifer calves. The registered cows averaged $225, the grade cows $100, and the grade heifer calves $60, per head. These were exceptionally good prices for this kind of cattle at that time. It is my judgment that the records of these cows made in the Jackson County Cow Testing Association, and made public on the day of the sale, added at least 15 to 25 per cent to the sale price of all cows and heifers."

7. COW TESTING INCREASES PROFITS

Cow testing lessens the cost and increases the profit by co-operative buying and selling of feeds, livestock, and their products. It stimulates farmers to be better dairymen and developes community spirit. By paying cash and purchasing feeds in carload lots, members have been able to reduce their feed bills materially. The member who cooperates in the purchase of feed stuffs, or in buying or selling cattle, frequently may save the greater part of his share of the expense in conducting the association work for the year.

Lack of cooperation among farmers today deprives them of many of the social and financial benefits of farm life. The cow testing association offers a simple form of organization for cooperation in the community. Because of its very definite purpose it insures an active working organization, which yields large returns for its members and the community as a whole. The regular and special meetings of the association, occasional farm tours and picnics give opportunity for discussing topics of particular interest and for obtaining outside speakers.

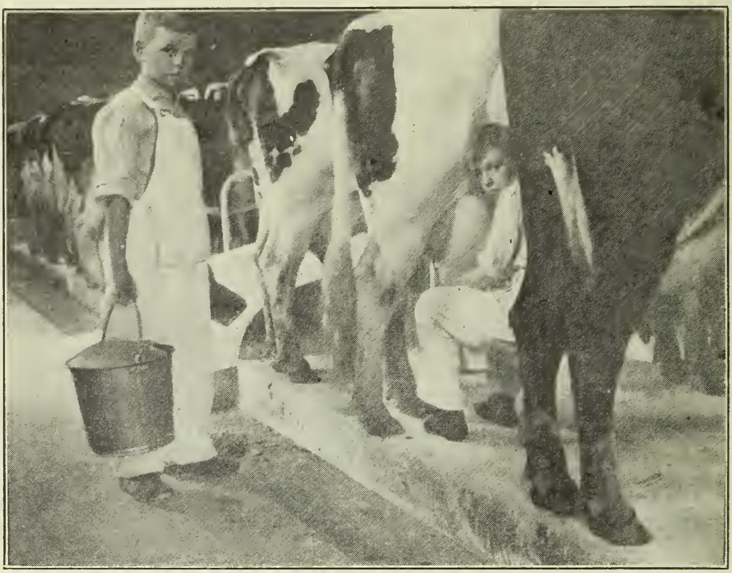
8. IT INTERESTS THE BOYS AND GIRLS, THE HIRED MAN, AND PUTS DAIRYING ON A BUSINESS BASIS

The cow testing association is one of the most effective means of checking the steady flow of young people from the farm to the cities, and of obtaining and retaining efficient help on the farm, because it makes dairying an interesting and profitable business.

There is sometimes a complaint that the dairy business is confining and that the boy or girl, or the hired man had rather do any other work on the farm than that in the dairy. Why?—because many of the cows are not worth keeping and the conditions under which they are milked are repelling. Cows are kept usually without profit on the average farm, because they are not cared for properly; they do not receive feeds of the right kind, nor in proper amounts; the cows are milked, fed and watered at irregular intervals. Also, on many farms the cows are so lacking in breeding, individuality and ability, that profitable production is impossible under any circumstance.

The cow testing association takes dairying out of such ruts and puts it on a business basis. It weeds out the unprofitable cows and helps build up higher producing herds. It demands the thought and care that create interest and enthusiasm.

The work of the cow testing association carried out faithfully, results in every cow returning a profit, and in making the business of dairying one of which the owner may well be proud.



Newton Consolver, 14 years old (sitting), and Marshall Consolver, 11 years old, are on the job every day and know what each cow in the herd is doing. Both take pride in producing high quality products.

HOW TO GET AN ASSOCIATION

Two things are necessary to get a cow testing association in a community. First, there must be at least 400 cows owned by 26 farmers; second, these dairymen must have the cooperative spirit, a real desire for the improvement of their own herds and for the betterment of the community in which they live.

If there are 25 or 30 men in any community, owning 400 or more cows, who would join such an association, the services of the county agricultural agent, or of the dairy extension specialist of the College of Agriculture should be enlisted. At first arrangements should be made for a representative of the Agricultural Extension Service to attend a meeeing of the dairymen and explain the work. At this time a general survey of the territory that can be covered will be made and if there are good prospects for securing a sufficient number of cows and men, the extension representative will assist local dairymen, as much as possible, in making a canvass for members.

As soon as the required membership has been obtained, a meeting will be called at some convenient center for completing the organization. The men who sign the contract constitute the membership. They then adopt a constitution and bylaws. The officers of the organization are a president and secretary-treasurer, who together with three other members constitute a board of directors, and are elected from the membership of the association. All money is collected by the secretary-treasurer, and all bills, such as payment of wages of the tester, purchase of testing outfit, sulphuric acid for testing, or any other expenses that may be incurred, are paid by him on order of the board of directors.

The Agricultural Extension Service will furnish free of charge all necessary blanks both for the regular work of the association and the monthly record sheets for individual members. A representative of the Extension Service will assist in organizing and supervising the associations without cost to the members.

WHAT IT COSTS

The cost will depend upon the number of cows obtained and upon the qualifications of the tester. As a rule in Missouri the cost is $1.50 per cow per year, with a minimum charge per member of $15.

MEMBERS' CONTRACT

WHEREAS, the .... COOPERATIVE COW TESTING ASSOCIATION is organized for the principal purpose of providing means for the cooperation of its members in ascertaining the relative merits of their cows, and for the improvement of their dairy interests; and

WHEREAS, it is proposed by the said Association to engage a suitable person for that purpose as soon as sufficient membership has been obtained, and said Association agrees, from monthly tests (twenty-four hours in length) made by this employee of the Association, to furnish each member with a record of the individual performance of each animal subscribed, and to advise the members in regard to economical feeding and the improvement of their herds; and

WHEREAS, we, by the act of affixing our SIGNATURES below, express our desire of becoming members of said Association, for the object above stated;

NOW THEREFORE, in consideration of our admission to MEMBERSHIP and the services mentioned, we make this agreement with said Association and with the other persons who are now or shall hereafter become members of said Association:

WE SEVERALLY AGREE and promise to pay to the treasurer of the Association the sum of one dollar and fifty cents ($1.50) for one year's record of each and every one of the cows in our respective herds as entered below opposite our signatures; with the following provisos, namely: That the charge for one herd shall not be less than fifteen dollars ($15); and that the tester shall not test more than thirty (30) cows in one day, but shall give two or more days' service each month in proportion to the number of cows in the herd, if larger than thirty; and we severally agree to pay for the yearly records of our herds on this basis. It is agreed that the rate of payment for additional cows entered after the year is begun shall be fifteen (15) cents per month per cow, or $1.50 per cow for the remainder of the year, at the option of the owner.

WE AGREE that if any cow in the test dies or is sold from the herd before the year is ended, there shall be no reduction in the amount to be paid; but another cow may be substituted in place of sold or dead cow. Aside from this no cow shall be replaced by another, in the number of cows undergoing the test. Before the second test the secretary shall be notified of the admission of all cows, whether substituted for ones previously in test or entered as additional cows.

WE SEVERALLY AGREE to make payments for such testing semiannually, the first payment to be due on or before the last day of the month in which the tester begins actual work, and the second payment to be due on or before the last day of the sixth month thereafter. And we severally agree to take or send the money to the treasurer of the Association without being called on therefor.

WE FURTHER AGREE to furnish board and lodging for the man employed as tester by said Association for at least one day of each month, and over Sunday and holidays, at the house to which his regular course brings him on Saturday or the day before a holiday; and to convey him to his next place of work, or should such person furnish his own conveyance, each one of us agrees to feed said person's horse while he is staying at the farm in lieu of furnishing him transportation to his next place of work.

WE JOINTLY AND SEVERALLY AGREE to be subject to the bylaws of this Association.

This agreement is not binding unless the said Association secures a sufficient number of cows to warrant starting operations.

The term of this agreement shall be ONE YEAR from the time testing begins.

For the ....

Cooperative Cow Testing Association.

Attest

....

Secretary President

Signature of Members

No.[1]	Date	Signature	No. of cows	Amount to be paid
1				
2				
3				
4				

WHAT SOME OF THE JACKSON COUNTY MEMBERS SAY

"I have been a member of the Jackson County Cow Testing Association since its started, and we are now in our fourth year of work. It has taught me the mistake I had made of not growing out my heifers and of breeding them too young. It has caused me to sell unprofitable cows which I would otherwise have retained in my herd. I believe that any man in the dairy business, who is not a member of a cow testing association, is losing money which the association can save him."—R. E. Shryock.

"We are much pleased with the results of the cow testing association work in our herd. It gives positive knowledge, without guess work, of what each cow is doing. It has showed me which heifer calves to raise and has been a wonderful help to me in the improvement of my herd."—C. C. Hook.

"I joined the association primarily that I might have at hand a source of information concerning better dairy methods, and from this standpoint it has paid me well. The tester has not only given me the full benefit of his own training and experience, but has given me the best methods of feeding, care and management practiced in the herds of the other members. It has located several 'boarders' in my dairy barn and I have eliminated them.

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[1] Space should be provided for thirty names.

"By reason of my membership in our association, my cows have been tested with regularity regardless of whether I was busy with other things, and more complete records have been kept than I could have kept myself. The association is a big step in the direction of organization and cooperation, which I believe are essential to successful and profitable dairying."—R. W. Barr.

The benefits of cow testing association work are accumulative: the monthly visits of the tester, the regular meetings and occasional field trips, discussion and interchange of ideas among the members: a study of the individual records not only increase the profits and value of each cow and her offspring, but also increase dairy knowledge, and create a new and permanent interest in dairy farming.

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UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

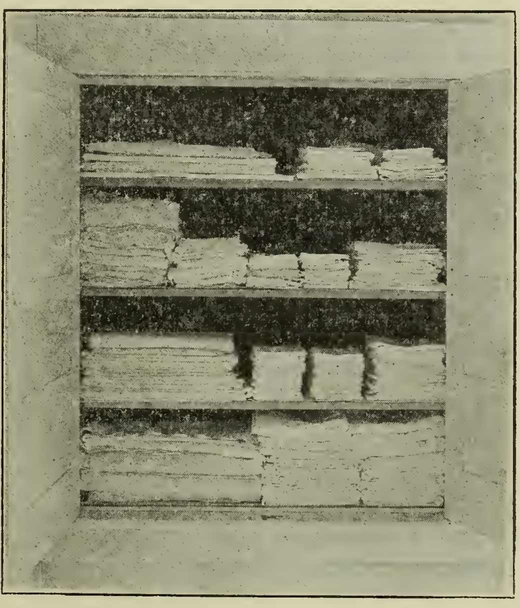
AGRICULTURAL EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 44 COLUMBIA, MISSOURI JANUARY, 1918

How to Select and Store Household Linens

Mary E. Robinson



The linen closet saves steps

The linen closet is one of the most important store rooms in the home and should be situated in a part of the house where it will be most accessible. The location of this closet and its contents will depend on whether the house has one or more floors. If the bedrooms and the bath are on the second floor, then the bed linens, dresser scarfs, bath and hand towels should be placed in a closet on the upper floor, preferably in the bath room or upper hallway; the table linen should be placed in the dining room on the first floor; the kitchen towels, dish towels and similar articles in the kitchen. If the house has one floor only, the bed linen and bath room linen should be placed in a bathroom linen closet, or in the absence of a bathroom, the closet containing those linens should be stituated in a bed room or back hall.

Steps may be saved by keeping the table linens in a drawer of a buffet or china closet in the dining room. The kitchen towels and dish towels may be kept in some convenient cupboard near the sink or table where the dishes are washed and the work is done.

The linen closet should be made mouse proof so that the linens may be cared for in the best way. This closet, by good arrangement, may be made very convenient. For example, the linens in constant use should be placed on the shelf nearest at hand—those used less frequently should be placed in the less convenient places.

The general tendency now-a-days in the up-to-date homes is to eliminate excessive fancy work on household linens. The general aim is to select these linens for utility and good wearing qualities.

Bedding.—Select cotton muslin with little or no starch for use in making sheets and pillow cases. Those in daily use should be of unbleached muslin which will bleach in the course of a few launderings and which wears much better because it has not been whitened by commercial means. Bleached cotton muslin which contains a large amount of starch is very flimsy when laundered and should never be purchased. Linen sheeting is an extravagance and even at high prices it is hard to find on the market.

Nine and ten quarter sheeting may be purchased for double beds; seven and eight quarter for single beds. Money may be saved by buying the ten quarter sheeting for single beds and making the sheets crosswise of the material with hems on the sides. Pillow tubing comes in 36, 40 and 42 inch widths. The width should be selected according to the size of the pillow. The finished sheet should be one-third of a yard longer than the bed; the pillow cases six inches longer than the pillow.

If the hems of bed linen in constant use are stitched by machine, they wear much better than those made by hand, and time is saved in the process of making. The plain or napery hem or plain hemstitching makes a more attractive article than that made by machine. A finish of this sort may be used for the linens which are used occasionally.

The top hems for sheets should be 2 inches to 3 inches and the bottom, three-eights to five-eighths inches. Pillow case hems should be 2 inches to 2½ inches or made to match sheets.

If trimming of any sort is to be used on bed linens, it should be as neat and as inconspicuous as possible. Trimmings in good taste are tatting, crochet, hair pin lace, or a simple monogram in embroidery or filet crochet. Tatting, crochet or hair pin lace wears best when used as insertion above the hem. Trimming on the edge of bed linens should be discouraged because of the raveling and wearing.

Blankets may be purchased in cotton, wool and cotton, and all wool. Wool is very expensive, but in the colder climates, or if the sleeping porch is used, a blanket of this type will be found necessary. Otherwise, except for old persons and infants, blankets of cotton or wool and cotton will furnish the needed warmth.

If greater warmth is desired, light weight comforters may be made of wool padding instead of cotton padding. These may have a covering of calico, silkaline, sateen or challie. Calico or sateen are the best materials to select for coverings where hard wear is necessary. The comforters will be more attractive if their colors harmonize with those of the room in which they are to be used. Materials may be chosen with backgrounds of tan or pale gray, which do not soil easily. The upper edge may be protected with white washable covers.

Buy plain, light-weight bed spreads. Those made of cotton crepe are especially good. They are reasonable in price, easily laundered and handled, and wear well. These spreads are most attractive in white, or with the addition of some color such as dainty blue stripes.

Toweling.—Money may be saved by purchasing the material for both bath and hand towels by the yard and finishing the ends with neat hems. A good quality of Turkish toweling shold be selected for the bath towels. Linen is the ideal material for hand towels because it absorbs moisture readily. However, because of the high price of linen and its scarcity, cotton huck must be substituted for linen toweling in many cases.

The regulation lengths of towels are: large towels finished, one yard long; guest towels three-fourths yard long. Hems should be one-half inch to one and one-half inches.

Dresser and buffet scarfs.—These are most attractive when made of some plain white material such as heavy linen, linen crash, Indian head, or similar goods. These materials wear well, and are easily laundered.

Table linen.—Time, strength and money may be saved by substituting, at least part of the time, cotton lunch cloths, table runners, doilies and napkins for the regular type of table cloths and napkins. These substitutions may be made for two meals in the day and the large table cloth used for the third meal, at the time when dinner is served.

The regulation hem for table cloths is one-half to one inch, and for napkins as narrow as possible, not over one-fourth inch. The hems for the napkins should be made on two sides only.

Kitchen linen.—Kitchen towels and dish towels should be made of strong serviceable materials. When the towels receive very rough use they should be made of sugar sacking or very coarse crash toweling. Linen crash toweling is one of the most satisfactory materials for this use as it absorbs moisture readily and wears well. However, union linen, which is a combination of linen and cotton, is being substituted in many places. Flour sacks, a cheap grade of unbleached muslin, or linen cup toweling may be used for the dish towels. The cup toweling is used by many persons for glassware as it leaves no lint.

The amount of household linens needed in each household depends entirely upon the number in the family and the rooms to be furnished. The following list gives the minimum amount which should be found in every well regulated home.

- Bedding
  - Sheets and pillow cases.—Three full sets for each bed (It is advisable to have an extra set in case of guests or illness in the family)
  - Blankets.—One pair for each bed
  - Comforters.—Two for each bed (One light weight and one with wool padding)
  - Spreads.—One for each bed and one extra.
- Dresser and buffet scarfs.—Two for each dresser and buffet
- Toweling
  - Bath and hand towels.—At least three of each per week for each member of the family. (If laundry is delayed for a week then twice this amount should be provided)
- Table linen
  - If doilies and lunch cloths are used, the following amount of table linen is needed:
  - Doilies.—Two sets
  - Luncheon cloths.—Two
  - Table cloths.—Three
  - Napkins.—Two dozen for the average family
  - If doilies and luncheon cloths are not used, six table cloths will be needed.
- Kitchen linen
  - Kitchen towels.—One dozen
  - Dish towels.—Three dozen

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UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

AGRICULTURAL EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 45 COLUMBIA, MISSOURI JANUARY, 1918

How to Cook Soybeans and Cowpeas

Wenona Windsor

I. SOYBEANS

Growing soybeans is not new to the American farmer, but cooking and eating soybeans is new to the American housewife. Soybeans have long been known as a valuable crop for increasing soil fertility and for feeding livestock, but housewives are just now learning that they make quite as valuable food for human beings and that they are unusually well fitted to take the place of much higher priced foods.

Soybeans are excellent substitutes for meat. They contain almost twice as much protein, or muscle building food, as average beef steak does, and a larger amount of fat than any legume except the peanut. They are a more nutritious food than the navy bean; they contain more protein, much more fat, more mineral matter and have a higher fuel value per pound. Like cheese, they are a rich and concentrated food and contain little or no starch; hence, like cheese and meat, they should be served with potatoes, rice or some starchy food. Soybean meal has practically the same composition as the whole bean unless some oil has been extracted in the process of manufacture.

Many varieties of soybeans are grown in Missouri, ranging in color from light yellow and green thru the brown to the black. The lighter varieties are best for food, since the darker ones have a strong, unpleasant taste.

The following methods of preparation for table use have been found satisfactory:

Green soybeans.—Soybeans three-fourths grown may be used like green lima beans. Cook until tender, changing the water once. Season with salt, pepper and butter or combine with a white sauce, made from one cup milk, two tablespoons flour and one tablespoon butter. If the green beans are first boiled in the pod, they will shell more easily.

Soybean meal.—Soybean meal is used in bread making much as corn meal is used. Owing to its high percentage of protein and its lack of starch, the best results are obtained in yeast bread when two-thirds wheat flour and one-third soybean meal are used. In quick breads, such as muffins or biscuits, even more can be used successfully.

Dried soybeans.—Dried soybeans require a longer period of soaking and longer cooking than navy beans. Soak them over night (12 to 16 hours) in fresh or salt water, drain, put on to cook in hot water and cook slowly until tender (6 to 8 hours) changing the water after an hour in order to remove the strong flavor from the beans. Soda is sometimes added to the first water to shorten the time of cooking but this is believed to destroy the vitamines of the beans, a most important constituent; therefore, it should not be used. If the beans are well soaked and cooked slowly they will become tender without soda. The use of hard water in cooking tends to harden the beans. If soft water is not available use water that has been boiled.

There are many appetizing ways in which soybeans may be prepared besides "plain boiled" and baked. With the suggestions given below, housewives can work out a number of palatable soybean dishes:

Soybean Soup

1 cup cooked soybeans, rubbed thru a sieve
1 quart water
4 tablespoons flour
2 tablespoons butter or butter substitute
1 chopped onion, or—
½ cup tomato catsup

Melt the butter and cook the onion in it until tender. Stir in the flour and add the water. When thickened, add the bean pulp. If the catsup is used it may be added just before serving.

Baked Soybeans

Parboil and drain two cups soybeans. Put into a baking dish, add one-fourth teaspoon mustard, salt, pinch of cayenne pepper and one-half cup tomato catsup or one-third cup molasses, as preferred. Add three small strips of salt pork, cover with water and bake until done.

Creamed Soybeans

Make a white sauce of 1 cup milk, two tablespoons flour, one tablespoon butter or butter substitute. Add two cups cooked soybeans, heat well in the sauce and serve. (Department of Home Economics, University of Missouri.)

Escalloped Soybeans

Use the proportions given above, alternating a layer of beans and a layer of sauce in a baking dish. Cover with buttered crumbs mixed with grated cheese and brown in oven.

Soybean Loaf

2 cups cooked soybeans ground in food chopper
1 cup cooked rice or mashed potatoes
1 chopped onion
1 tablespoon chopped green pepper
2 tablespoons drippings
1 beaten egg
Salt - pepper

Mix well, form into a loaf and bake in oven. Serve with a brown or tomato sauce. These same proportions may be used for croquettes. Shape, dip in egg and crumbs and fry in deep fat.

Soybean Salad

Cook and drain one cup soybeans. Add one small onion, chopped, four small sour pickles, paprika and celery seed, or one-fourth cup chopped celery. Serve with a boiled dressing. (Department of Home Economics, University of Missouri.)

Browned Soybeans

Soak soybeans overnight in salt water. Drain and fry in deep fat. These may be used in candy making like peanuts. (Department of Home Economics, University of Missouri.)

Soybean Bread

1 cup liquid (milk or water)
1 tablespoon fat
1 tablespoon sugar
1 teaspoon salt
¼ to ½ cake of yeast
2 cups white flour
1 cup soybean meal

Make a sponge using white flour. When this is light, add the remainder of the flour and the meal, let rise, knead, place in pans, let double in bulk and bake.

Soybean Wafers

1½ cup soybean meal
1½ cup flour
1 teaspoon salt
½ cup milk
2 teaspoons baking powder
¾ cup sugar
4 tablespoons butter or butter substitute

Mix to a stiff dough. Roll very thin, cut with biscuit cutter and bake ten minutes. (United States Department of Agriculture.)

II. COWPEAS

Cowpeas, like soybeans, are generally used for feeding stock and many people do not know their possibilities for table use. Cowpeas are good to eat, easy to cook, economical and well adapted to various palatable methods of preparation. They are really a species of bean and belong to the legumes, which have a large amount of protein and serve as substitutes for meat. The composition of the cowpea is very similar to that of the navy bean and the uses and methods of preparation are much the same. Cowpeas contain more protein or muscle building material and more mineral matter per pound than average beef and their food value per pound is higher. They are low in fat but when this is added in cooking, cowpeas may well be used in the place of meat. The white and the blackeyed varieties have the most delicate flavor.

Cowpeas may be used green, either shelled or in the pod, and cooked like garden beans. The dried form, however, is more generally obtainable. Like all legumes, cowpeas should be well cooked so that the digestive juices can penetrate the cellulose seed coats and reach the nutritive material. Note the following suggestions:

1. Soak in lukewarm water several hours or overnight.
2. Simmer slowly until tender.
3. Do not use soda in the water. Soaking and slow cooking will make the peas sufficiently tender.
4. Season well. Pork fat, cheese, onion, green pepper, celery or tomato combine well with cowpeas as seasonings.

Cowpeas may be prepared for table use according to any method which is used for navy beans. The following recipes will suggest a variety of ways in which they may be served:

Cowpea and Vegetable Soup

Soak one cup cowpeas overnight and cook. Add one chopped onion, one cup tomato juice and any small amount of left-over vegetables, such as cabbage, cauliflower, turnips, and carrots. Then add two tablespoons butter or butter substitute and thicken with a little flour.

Cowpea Soup

1 tablespoon butter or pork fat
1 tablespoon chopped onion
1 stalk chopped celery
1 cup dry cowpeas

Soak the cowpeas over night. Fry the vegetables in the fat, add the soaked cowpeas and the water in which they were soaked. Cook slowly until tender. Run thru a sieve, add water, thicken with a little flour and serve. (United States Department of Agriculture.)

Baked Cowpeas

1 quart parboiled cowpeas
¼ pound salt pork
½ teaspoon mustard
1/3 cup sorghum molasses
Salt
Pinch of cayenne pepper

Cover with water and bake slowly several hours.

Baked Cowpeas No. 2

Bake as above, substituting for the molasses:

1 onion
2 cups tomato juice
¼ cup vinegar
1 tablespoon sugar

Cheese and Cowpea Loaf

2 cups cooked cowpeas mashed or run thru a sieve
½ cup grated cheese
1 tablespoon chopped green pepper
1 tablespoon butter or butter substitute.
1 small onion chopped

Cook the vegetables in the fat, mix with the peas and cheese and form into a loaf. Bake, basting with butter and water. Use as a meat substitute, either hot or cold. (United States Department of Agriculture.)

Escalloped Cowpeas

2 cups cooked cowpeas
1 cup cheese sauce

Place in baking dish, alternating layers of peas and sauce. Cover with buttered crumbs and brown in oven.

Croquettes

1 cup cowpeas, cooked, drained and ground
2 hard boiled eggs, chopped
1 tablespoon chopped onion
1 tablespoon chopped parsley
Salt - pepper

Mix, form into croquettes, dip in egg and crumbs and fry.

Puree of Cowpeas

One pint cowpeas cooked, drained and run thru a sieve. Season with salt, pepper, butter, milk and two teaspoons brown sugar. Serve like mashed potatoes. (United States Department of Agriculture.)

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UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

AGRICULTURAL
EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 46 COLUMBIA, MISSOURI JANUARY, 1918

How to Save Fats

Bab Bell

Fats are derived from two sources—animal, represented by lard, butter, cream, beef fat, mutton fat, and poultry fat; and vegetable, represented by corn, cottonseed, olive, peanut, cocoanut, soybean, and sesame oils.

Formerly more animal fats than vegetable fats have been used. Butter and lard were plentiful, accessible, and in convenient form for household use. The average housekeeper depended upon them to the exclusion of all other forms of fat. Since there is a shortage in these particular fats, housekeepers must learn (1) to economize in the use of these by cutting down the amount of fat used and (2) to substitute, wherever possible, vegetable fats in place of animal fats.

Food Value.—It should be remembered that fat yields two and one-fourth times as much energy for the body as equal weights of carbohydrates or protein. More and more is the importance of fat in the diet being recognized. Thirty per cent of the total number of calories needed in the diet should be furnished by fat. In the ordinary diet this is approximately four tablespoons or one-fourth cup.

Digestibility.—The digestibility of fat is of importance, especially when making substitutions. Generally speaking animal fats and vegetable fats are equally digestible. Recent investigations have shown that there is very little difference in the digestibility of fats that have a melting point below body temperature. While eating large quantities of fat may retard the digestion of food, it is unlikely that any serious discomfort will be felt if it is prepared intelligently. Fats in general are completely digested but require a longer time than most foods.

Butter.—Butter is the most widely used of all fats. It has been estimated that from 17 to 18 pounds per person are consumed yearly. There are many good and wholesome butter substitutes on the market which may be used both for cooking and table use. However, if these are used exclusively in the feeding of children, care should be taken that the supply of whole milk should not be decreased. Whole milk and butter both contain certain substances essential to growth which are entirely lacking or present in small quantities in butter substitutes.

Oleomargarine.—Oleomargarine is a name given to butter substitutes made by churning fats other than butter with milk or cream. The principal fats usually used in the manufacture of oleomargarine are oleo oil made of beef fat and neutral lard made of leaf lard and cotton seed oil. Oleomargarine is a good wholesome product and there should be no objection to its use if it is properly labeled. The best grades of oleomargarine contain nearly one-third as much of the growth promoting substances as butter does.

Beef fat.—Beef fat is harder than lard and has a more pronounced flavor. For these reasons it is not used extensively in cooking. However, in certain dishes, finely chopped unrendered suet is used and in some countries, drippings from the cooked beef or rendered beef suet are used in place of butter on bread.

Since suet alone is of a hard consistency, a good and satisfactory compound may be had by mixing some oil, such as cottonseed oil or corn oil, with it. Mix one part of oil with two or three parts of rendered suet. If one half cup of skim milk be added to one cup of suet before rendering, the flavor is improved. In summer, suet may be added to lard in small amounts to give a harder fat.

Lard.—Lard is one of the most commonly used animal fats. It is made from the fat of hogs and heretofore has been plentiful and comparatively cheap. Owing to the fact that most women are in the habit of using lard, it is somewhat difficult to accustom them to the use of vegetable oils and fats.

Cottonseed oil.—Cottonseed oil is obtained from the seeds of the cotton plant. One ton of seeds yields 50 gallons of oil. Preparations made of cottonseed oil are sold in the liquid form. In addition cotton seed oil is treated chemically to form hard fats such as those sold as compounds or lard substitutes. All of these compounds have been found to be good and wholesome products. Combinations of cottonseed oil and animal fats are also on the market. The label on all packages gives the ingredients.

Corn oil.—This oil, which is made from corn, has only lately come into general use for food purposes. The flavor is pronounced but is not considered objectionable.

Peanut oil.—The oil made from peanuts is comparatively new in this country, since peanuts have been disposed of in other ways. Its use in cookery is very limited at the present time. It has a more pronounced flavor than either corn oil or cottonseed oil.

Olive oil.—Olive oil is prepared from the olive fruit and is one of the oldest oils now in use. The flavor depends upon the variety of olive, ripeness when picked, manner of handling, length of time of storage, etc. The extensive use of olive oil is due to its flavor. Olive oil has no more food value than the other oils. Its high price is due to its flavor alone.

All fats have advanced in price, yet a great saving may be made by investigating the available fats on the market, their composition, and their prices. As a general rule fats are less expensive when purchased in large quantities. A decided saving may be made by purchasing oils in gallon receptacles and harder fats in corresponding amounts.

In recipes calling for butter any of the following fats may be substituted in the quantities given for one cup of butter: 1 cup (scant) oleomargarine; 4/5 cup lard; 4/5 cup rendered poultry fat; 4/5 cup vegetable fat or oil.

Savory fats.—Savory fats may be made when undesirable flavors are to be eliminated. Usually strong seasonings, such as thyme, sage, marjoram, summer savory, bay leaves or onions are added to unrendered fats, having pronounced odors or flavors like those of beef or mutton. These seasonings mask the strong original flavors. Render in a double boiler and strain carefully thru a flannel cloth so that all bits of herbs are removed. Adding salt after rendering improves the flavor.

Savory fats may also be prepared from rendered fats by adding the seasonings, heating the mixture and straining.

Fats with strong flavors such as suet and mutton fat may be improved by heating with water, milk, or charcoal. If charcoal is used, all pieces may be removed by straining thru a heavy cloth.

Care of fats.—All fats which are to be stored for some time should be protected from heat, light, and air to prevent them from becoming rancid. Keep in tightly covered receptacles and in a cool, dark place.

In summer time scraps of fat which are saved should be rendered promptly to prevent them from becoming rancid. It is also important in rendering or clarifying fats that all moisture be driven off since molds are very apt to grow if fats contain moisture.

Keep butter, oleomargarine and other butter substitutes in a cool place away from foods having strong odors, since odors are readily absorbed by these fats. Store the oils in closed cans or bottles wrapped in paper in a cool place—the refrigerator is preferable.

How to render fats.—Chop fats to be rendered into small pieces or put them thru a meat chopper and heat in a double boiler until all the fat has melted. The use of a double boiler prevents too high a temperature. If fat is overheated it will become rancid. Strain thru a cloth, heat again to sterilize and drive off moisture.

How to clarify fats.—Method 1.—Melt the fat with an equal proportion of water in a double boiler. Strain thru a cloth. When cold remove the layer of fat from the water.

Method 2.—Follow directions given in 1, using sour milk. Flavors and odors are modified.

Method 3.—Follow directions given in 1, adding several pieces of clean hardwood charcoal. If beef fat is being clarified, the yellow color is removed and a white odorless fat is secured.

In many homes the practice of making soap from drippings, trimmings and similar products has long been the custom. At present when fats are so scarce every effort should be made to utilize every particle for food. If the scrap jar is watched carefully, no fats will be available for soap making.

Many people are eating more fat than their bodies require. This extravagance means that soldiers and working people, who need generous amounts of fat, will be denied this necessity. If everyone realized the seriousness of the situation and would cut down on his daily allowance of butter, cream, oil and cooking fat, a large amount of fat would be saved.

TIMELY SUGGESTIONS FOR FAT CONSERVATION

1. Eat just enough fat to supply body needs. Thirty per cent of the total number of calories in the ration, or four level tablespoons, is sufficient.
2. Leave no fat on the plate. This means fat from meat as well as butter.
3. Serve foods in the preparation of which little or no fat is used. Eliminate rich cakes and pastries whenever possible.
4. Omit fried foods.
5. Use cooked salad dressings which require less fat.
6. Use the drippings from roasts, sausage, bacon and boiled meats as seasonings.
7. Keep all rinds of bacon and salt pork to be used as seasoning when cooking cabbage, greens, vegetables, soups, etc.
8. Save all trimmings from beef, pork, mutton and fowl. Render and use in cooking.
9. Keep a small jar for bits of fats, drippings or gristles. When a sufficient amount has been collected, render the contents.

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UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

AGRICULTURAL
EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 47 COLUMBIA, MISSOURI JANUARY, 1918

How to Save Sugar

Mary E. Robinson

The average American eats approximately 90 pounds of sugar a year. This includes not only the amount eaten at the regular meals but also that taken between meals in the form of candy, cakes, ice cream and soft drinks. Such large amounts are taken because of the flavor of sugar rather than because there is any necessity for it in the diet. The energy value which it yields may be furnished equally well by cereals and starches. Appetites have been pampered by the use of highly seasoned and flavored foods which could be foregone if more rational tastes were cultivated. If the nation is to conserve sugar, each person must watch his diet carefully.

Sugar is used as a source of energy for the body. When eaten in excess, it tends to ferment and cause digestive disturbances. The average amount of sugar which may be eaten by an adult per day is four tablespoons; or four tablespoons of honey, three and one-half tablespoons of syrup or four tablespoons of molasses may be substituted. However, laborers, soldiers on long marches, athletes, or school children may use more sugar in the diet than less active persons of the same size and weight. In the case of children there is danger that in eating too much sugar, especially in the form of candy, the appetite will be dulled for more wholesome foods, and a lack of mineral matter in the diet will result.

Cane sugar is found in fruits and juices of many plants. Only two plants, the sugar cane and the sugar beet, play an important part in the world's supply of sugar. The manufacture of sugar from the maple tree and palm tree is a relatively small industry.

The following table gives the composition of the sugars and syrups in common use.

	Water per cwt.	Protein per cent	Fat per cent	Total carbohydrates per cent	Mineral salts per cent	Fuel value in calories per pound
Sugar—Granulated (Cane or beet)				100		1814
Sugar—Brown				95		1723
Sugar—Powdered				100		1814
Sugar—Maple	5			93		1685
Syrup—Maple	34.2			64		1160
Honey	18.2	.4		81.2	2	1470
Molasses—Cane	25.1	2.4		69.3	3.2	1300
Syrup—Corn	19.0			80.5	0.5	1468
Sorghum	28.6			63.3	4.0	1154

(Sherman's Food Products)

SUGGESTIONS FOR CONSERVATION OF SUGAR

(1) No adult should eat more than four tablespoons of sugar per day. A part of this amount may be in the form of honey, syrup or any other equivalent sweet.

(2) Reduce to a minimum the amount of sugar used in beverages. Many beverages are served sweeter than they need be and sugar is often left in the cup or glass in which they are served.

(3) If cereals are prepared carefully, salted and thoroly cooked, they will be palatable without the addition of sugar. If the sweet taste is desired, sweeten the cereals with fruits rather than sugar—for example raisins and dates can be used with oatmeal.

(4) Use recipes calling for less sugar, especially for cakes and other desserts; substitute corn syrup, sorghum, honey, apple syrup and other fruit syrups for this sugar.

(5) Use more fresh, dried and canned fruits and less sugar will be desired.

(6) Omit rich, heavy desserts requiring sugar, such as puddings with rich sauces, iced cakes and sugar pies.

(7) When sugar is craved, buy fruits instead of candy, ice cream and soft drinks. Fruits will be better for the body and the substitution will render a patriotic service.

(8) Give children fruit, fruit juices, fruit breads and fruit cookies instead of candy and rich cake.

Any woman may conserve sugar by substituting honey, syrup or molasses in the following proportions for the sugar in the recipes which she uses. Any one of the following is equivalent in food value to one cup of sugar:

1 cup maple syrup	4/5 cup karo (light or dark)
1 cup sorghum	1 cup honey

When karo syrup is used the amount of karo must be increased by one-half if it is desired that the finished product be as sweet as a product sweetened with granulated sugar.

The foregoing substitutions were worked out by Miss Lois Lhamon of the Department of Home Economics, University of Missouri.

SUGARLESS CANDIES

It is almost impossible for the American people to break themselves of the candy eating habit. Therefore, at this time some form of confection should be substituted which requires little or no sugar. The following sugarless recipes are suggested.

Stuffed Dates

Remove seed by splitting the fruit lengthwise. Fill the center with chopped nut meats or cherries and wrap in oiled paper.

Fruit Squares

Run equal parts of figs, raisins and dates thru the food chopper. Add one-fourth this amount of cocoanut or nuts. Moisten with orange juice. Shape into balls or squares. These may be dipped into melted chocolate or not, as desired. Dried peaches, apricots or prunes may be substituted for fruits given above.

Dried Pineapple

Peel fruit and slice crosswise in very thin slices. Place in an oven, the door of which is left open, or in a drying rack over the stove. Dry as for apples.

Syrup or Molasses Taffy

3 cups syrup or sorghum	1 teaspoon vinegar
1 tablespoon butter	

Cook syrup until it forms a hard ball when dropped into cold water. Add one tablespoon strong vinegar for flavoring. Pour on cold buttered platter. Allow to cool until it can be easily handled and pull until light.

Caramels

2 cups sorghum or karo syrup	½ cup cream or condensed milk
1½ squares chocolate	2 tablespoons vinegar

Cook until it forms a firm ball in cold water. Pour on buttered pan and when cool cut into squares. Wrap in wax paper.

MISCELLANEOUS RECIPES CONSERVING SUGAR

Sorghum Ginger Bread

1 cup sorghum	¼ cup fat (melted)	1 teaspoon ginger
1 cup sour milk	1¼ teaspoons soda	½ teaspoon cinnamon
2 1/3 cups flour	½ teaspoon salt	½ teaspoon allspice

Sorghum Ice Cream

1 cup sorghum, maple syrup or honey	3 cups milk
	3 egg yolks

Make a custard with egg yolks and milk, add the sorghum and freeze.

The following table shows substitutions which may be made for granulated sugar in a standard cake recipe.

	Flour	Fat	Sugar or syrup	Eggs	Liquid	Baking powder
Standard Recipe	3 cups	1/2 cup	1 1/2 cups granulated sugar	Whites 4 or 2 whole eggs	1 cup	2 teaspoons
Substituting sorghum[1]	3 cups	1/2 cup	1 1/2 cups sorghum	Whites 4 or 2 whole eggs	2/3 cup	2 teaspoons
Karo[2]	3 cups	1/2 cup	1 1/5 cups karo	Whites 4 or 2 whole eggs	4/5 cup	2 teaspoons
Honey[3]	3 cups	1/2 cup	1 1/2 cups honey	Whites 4 or 2 whole eggs	4/5 cup	2 teaspoons
Maple Syrup	3 cups	1/2 cup	1 1/2 cups maple syrup	Whites 4 or 2 whole eggs	2/3 cup	2 teaspoons

This standard cake may be varied by adding 3 squares of chocolate to make a devil's food cake or spices, nuts, fruit, or other flavorings may be added for variety.

[1] Add 1 teaspoon soda for each cup sorghum.

[2] When karo syrup is substituted in cakes, as given above, the cakes will not be as sweet as if granulated sugar is used, but the food value will be the same. If a sweeter cake is desired the amount of karo used may be increased to two cups and the liquid decreased accordingly.

[3] Add ¼ to ½ teaspoons soda for each cup of honey.

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UNIVERSITY OF MISSOURI **COLLEGE OF AGRICULTURE**

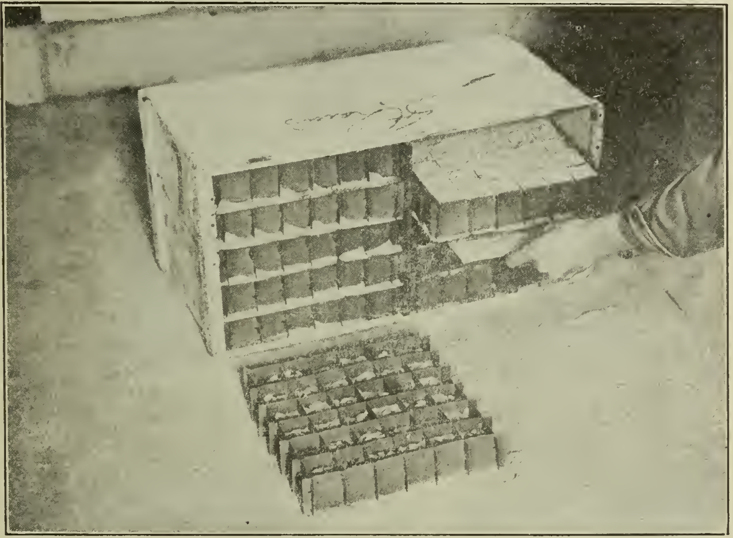
AGRICULTURAL EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 48 COLUMBIA, MISSOURI FEBRUARY, 1918

How to Test Seed Corn

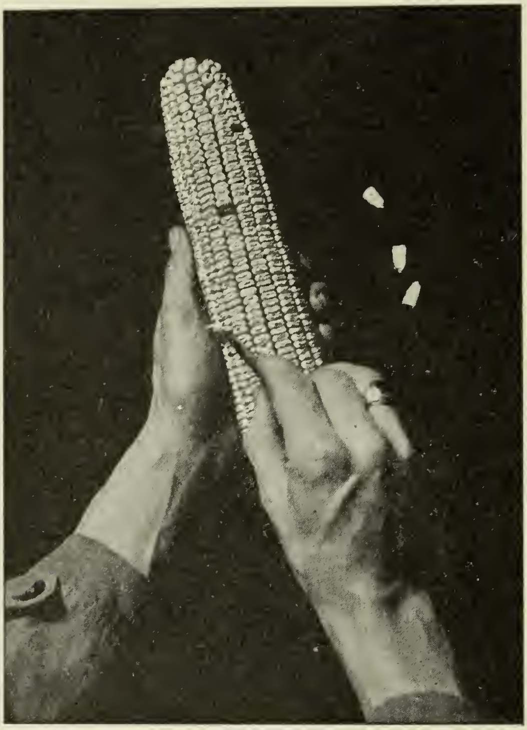
J. C. Hackleman



Egg Crate Tester

Obviously the corn field is an expensive seed tester. Yet farmers persist in planting untested seed with the result that they must replant or be satisfied with a poor stand, a consequent reduction in yield and a lower return. A Missouri newspaper is credited with the remark that it is some trouble to test seed corn but it is more trouble to replant. Unfortunately too many neither test nor replant. In normal times, that is the farmer's business, but during the war, the nation has a right to expect that every ear of seed corn be tested.

From the farmer's viewpoint no work which he can do in January, February, or even most of March will be any more profitable than testing his seed corn, yet not more than five per cent of Missouri farmers ever practice it. This has been so commonly neglected that few of even the most progressive farmers stop to consider what little work is necessary and how quickly the seed for an entire crop can be tested.



Removing Kernels from the Ear
Care should be taken to sample all parts of the ear

Stands of 70 to 85 per cent have become so common that many farmers do not realize that better stands can be had. In some sections a 75 per cent stand is considered good enough. Nothing short of the best possible stand is good enough, and 95 to 100 per cent can be had by three-fourths of the farmers. During last year a contest was conducted by the Missouri Corn Growers' Association and careful field notes were taken on the five acre plot of each contestant. The average stand of corn on the plots where the seed had been tested was 92.9 per cent and the average yield was 71.33 bushels. Those fields which were planted with untested seed gave an average stand of 72.1 per cent and an average yield per acre of 52.24 bushels.

These figures, taken from actual farming operations of last year, show the value of a test for seed vitality; and no one can contend that those farmers whose stand of corn was 92.9 per cent were not more than paid for all their labor.

SEED TESTING PAYS

The most serious objection that is usually raised to the practice of seed corn testing is that the cost of the test offsets all the gain made. This argument is answered in the case cited, for the difference in yield per acre was almost as great as the difference in per cent of stand. Granting that fertility and moisture as well as stand were factors in making this 19 bushel gain in yield, the value of seed testing is shown by the following: A 20 per cent loss in stand would mean, in the average cornfield, a loss of 1778 stalks per acre. If each of these stalks had produced an eight ounce ear, which was below the average on these plots, the additional corn would have meant 12.5 bushels which at current prices (December 1, 1917) would have been worth $10.75.

The time required to make a germination test will depend somewhat upon the kind of tester used and how well the farmer is prepared for testing, but will surely not require a total of more than two hours per bushel, since 45 minutes per bushel is time enough under favorable conditions. At this rate a man can test five bushels of seed corn or enough to plant forty acres, in ten hours.

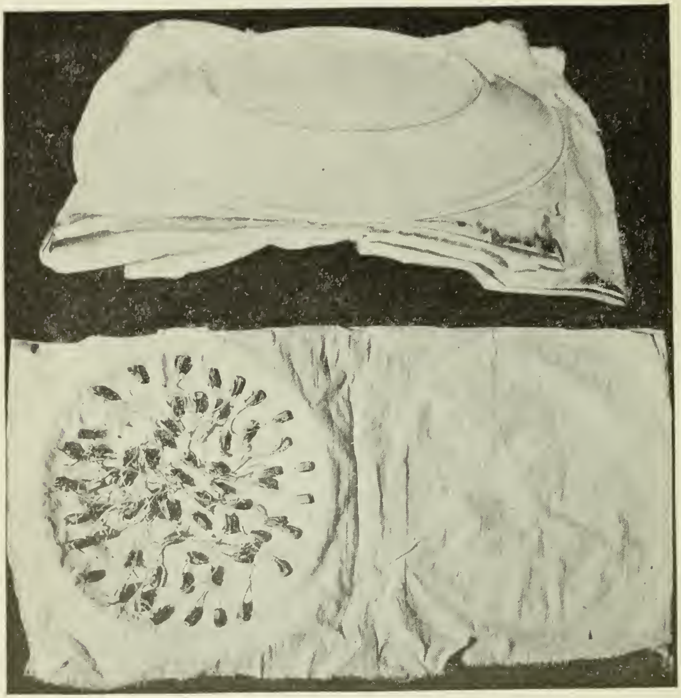
This disproves the old objection that conducting a germination test takes too much time or is too expensive. As a matter of fact if but one ear of corn is taken out of every fifty tested the time spent will be very profitable as one would be saving at least three bushels of corn for each hour of work.

KINDS OF TESTERS

There are several germinators on the market, most of which are satisfactory and, when used with reasonable care, give excellent results. These testers are all constructed on the principle of supplying a limited amount of moisture in a chamber, the temperature of which is kept more or less uniform.

These commercial testers vary in complexity all the way from the simple box-like chamber, heated from below with a lamp, to the much more elaborate one which is heated by electricity and in which the temperature is very accurately maintained by a self-regulating thermometer or rheostat.

Some farmers are using old incubators quite satisfactorily. The incubators can be used with sand or sawdust or with moistened cloths. In the former case the trays are filled with sand or sawdust and the kernels imbedded. In the latter case cloths are spread in the tray, the kernels placed on a cloth and other cloths spread over them. In both cases, of course, moisture must be supplied.



Dinner Plate Tester

Still another type of germinator which is being used is the grain sprouter employed by poultrymen for preparing trays of green feed for chickens. These sprouters work quite satisfactorily where the temperature is mild enough or where the temperature in the sprouter can be controlled. Where the sprouter is employed, sawdust is frequently used to fill the trays. A cloth is spread over this and is marked off in squares. Another cloth covers the kernels, and in case more than one layer is tested, another cloth which is marked off in squares is spread over this. This process may continue until three or four depths are tested in each tray of the tester. The last layer should be covered with a cloth, and then, a sawdust pad, old sacks, or carpet should be spread over this to hold the moisture. The cover should be moistened down daily with warm water.

The type of germinator to use is of little consequence so long as the conditions which favor germination are provided. The essential precaution is to supply enough moisture and warmth to cause the seed to sprout. These conditions must be provided.

HOME MADE TESTERS

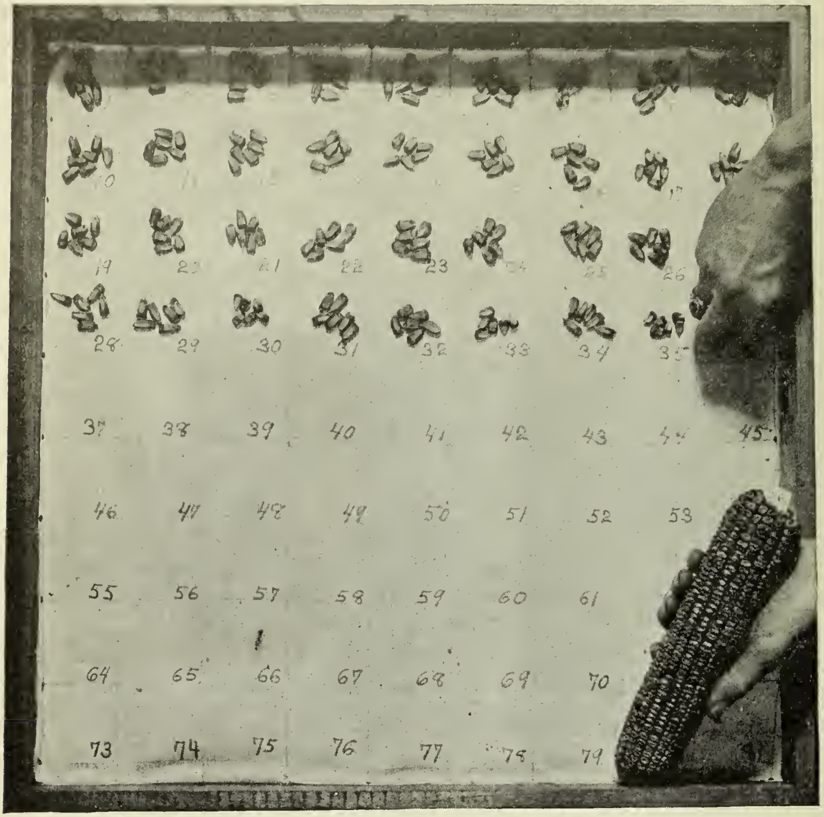
The kinds of germinators in which the farmer is naturally most interested are those which are simple, quickly and easily constructed at home. There are several such germinators and when carefully handled will give almost equally satisfactory results. The most common ones are: (1) dinner plate germinator (2) sand box germinator (3) sawdust and cloth box germinator and (4) the rag doll germinator.

Dinner plate tester.—The first or dinner plate germinator is perhaps the simplest of all. This tester is not very valuable where individual ear tests of corn are to be made, especially if there are many ears; but where bulk tests from shelled corn or where a "shotgun" test from a large number of ears is to be made, this method is fairly satisfactory. A large piece of blotting paper or several thicknesses of cloth should be spread out in a plate. This cloth should be saturated with water, the kernels of corn placed on this cloth, and then the remainder of the cloth folded back over the kernels. This upper cloth should be moistened thoroly, but not sufficiently to cause water to stand in the lower plate. A second plate should be inverted over the first, containing the blotter or cloth and the corn, and then the germinator set aside. This should be observed daily and if it begins to dry, more water should be sprinkled over the cloth or blotter.

Sand box germinator.—The second or sand box germinator consists of a box about three inches deep and of any convenient size, filled with sand, and then marked off with strings stretched across the top of the box each way, making 2½ to 3 inch squares. (See page 11). Then by lettering the squares down the left hand edge of the box A, B, C, etc., one can locate a given square, as for example, C - 6 immediately. By labeling the ears as the grains are selected for the test, the good and bad ears can be distinguished when the test has been made.

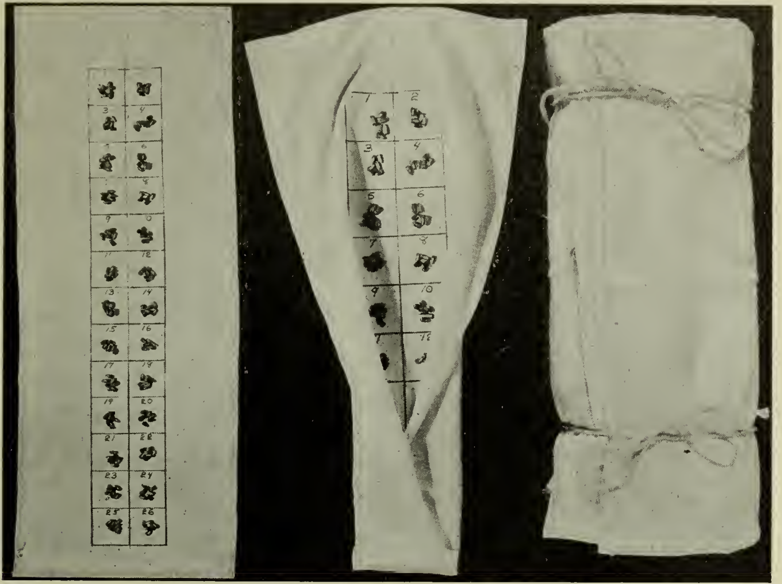
This type of germinator has a few objections, which in many cases, perhaps, make its use almost prohibitive. First, sand is sometimes not available; second, such a box is heavy and unweildly; third, after the test is made the sand should be removed and re-sifted to get it in best shape for the next test, and fourth, it is objectionable because of the dirt, especially when it is used in the house.

Sawdust box germintor.—The third, the sawdust box germinator, may be made similar to the sand box except that here the sawdust is simply used to retain the moisture and the corn is placed on a cloth marked in squares which have been numbered. This cloth may be marked with a pencil. The next step is to spread over the kernels a thin cloth, thin pad filled with sawdust or a few thicknesses of cloth. A too thick pad or too heavy covering of cloth must be avoided. Two thicknesses of flannel or three or four thicknesses of muslin will be ample. This should then be kept moist and, like the sand box, should be in a moderately warm, but not hot, room.



Sawdust Box Tester
The kernels from ear 36 belong in square 36

Rag doll tester.—The rag doll tester, which is perhaps the least expensive and about as satisfactory as any, can be made of a piece of muslin eighteen inches wide and of any desired length, depending on the number of ears to be tested. If the tester is to accommodate twenty ears of corn, a piece of cloth eighteen inches wide and four feet long will be ample.



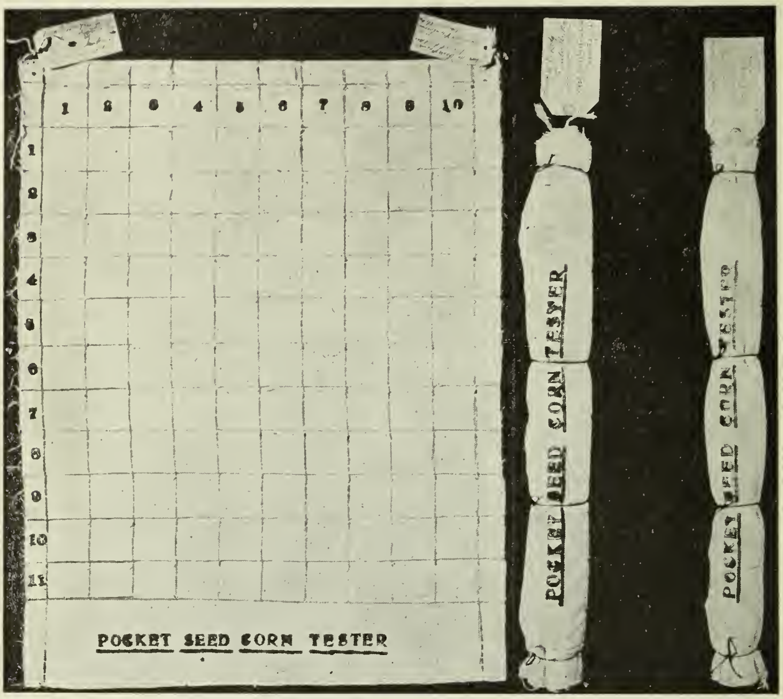
Rag Doll Tester

Kernels placed Folded and Beginning to Roll Roll tied up

The cloth should be marked off in 2½ or 3 inch squares as indicated on page 7. These squares may be smaller or larger as occasion demands, but in general the 3 inch square is large enough to accommodate as many kernels as will be used—usually not more than ten. At least six inches of cloth should be allowed on each end of the tester beyond the squares.

After the kernels have been removed from the ear and placed in the numbered squares, the sides of the cloth may be folded over and the "doll" may then be rolled up without fear of molesting the kernels. The cloth which was left at either end permits starting and finishing the roll without losing the kernels.

The rag doll should be thoroly moistened either by sprinkling with warm water or by immersing in a bucket of warm (not hot) water for two or three hours. After the cloth has been thoroly saturated it can be put away in a warm place. The rag doll must not be allowed to dry, as moisture is essential. A good method of maintaining the moisture in the rag doll tester is to put it in a shoe box or small wooden box and cover it with moist sawdust. As with other testers, the sprouting kernels must not become chilled, as this will not only retard, but may actually prevent, the germination of the grain.



Every Ear Pocket Tester

Spread out to show method of numbering

Rolled up as it appears when filled ready to mail

J. Robert Hall, county agent for Cass county, has devised a tester which can be mailed to the farmer and after he has filled it with six kernels from each ear he can mail it back to the farm bureau office, the local bank, or commercial club or any other central place where the test is to be made. Mr. Hall describes this as follows:

The every ear pocket tester.—"Obtain a good grade of canton flannel, six ounce if possible. The cloth should be twenty-seven inches wide or wider. Cut a piece forty-four inches long and fold it with the flannel sides together. By sewing seams both ways, make inclosed squares two inches by one and three-quarter inches. To make the squares, begin one inch from the edge and run seams every two inches (eleven will be required) across the long way of the doubled cloth. Then across the narrow way (22 inches) take a seam one inch from one edge (this will be the top) and sew seams every one and three-quarter inches until there are twelve rows of pockets in the tester. This will leave a flap of about five inches at the bottom of the cloth to serve as a protection, which will prevent the kernels of corn from losing out of the bottom pockets when the tester is rolled for mailing.

"It will be seen that the seams have divided the cloth into squares, two by one and three-quarter inches. There are twelve rows, each containing ten squares. Thus the cloth is quilted but the pockets are not open. An opening must be cut into them. Care must be taken at this point to make the openings at the proper place. The flap remains at the bottom. Take care not to cut the bottoms out of the pockets or the flap will be on the wrong end to serve its purpose. Beginning at the upper end of the tester, opposite the flap, insert a sharp pointed knife thru one ply of the canton, one-quarter inch from the upper seam; and cut across to the next seam, making a two inch opening into each pocket. This really makes the pocket one and one-half inches deep and leaves enough cloth below the seam at the bottom of each pocket to prevent the kernels from dropping out.

"The pockets may be numbered at this stage but they are more easily numbered before the openings are cut. Use only a soft lead pencil as ink will run when the cloths are wet. Number the pockets consecutively up to 120, or letter the rows, and at the top edge place a figure to represent the number of each pocket in each row. Each tester is designed for testing enough ears for ten acres."

After this tester has been filled and is ready for use it should be soaked for two to four hours in warm water to insure thoro saturation and may be spread out or left rolled up to await the result of the test. In case this tester is spread out it should be placed on moist sawdust, or sacks and have moist cloths or sacks spread over it to prevent drying out. Additional warm water will probably be needed each day to keep the tester moist. In case several such testers are used they might be piled three or four deep and thus serve to keep moisture in all.

At the end of four to six days the tester will be ready to read. It should be tacked up or held up, and the person examining must dig the sprouted and dead kernels out of each pocket. This must be done rather carefully else the sprouts will be broken off and the conclusions regarding the quality of the corn will not be correct.

Egg crates for testers.—In some places where large quantities of seed corn are to be tested and where the space available for the testers is somewhat cramped, egg crates have been very satisfactorily used. These boxes or crates are particularly useful where large quantities of seed are to be tested at a central testing station, such as a county farm bureau office, commercial club, or a bank.

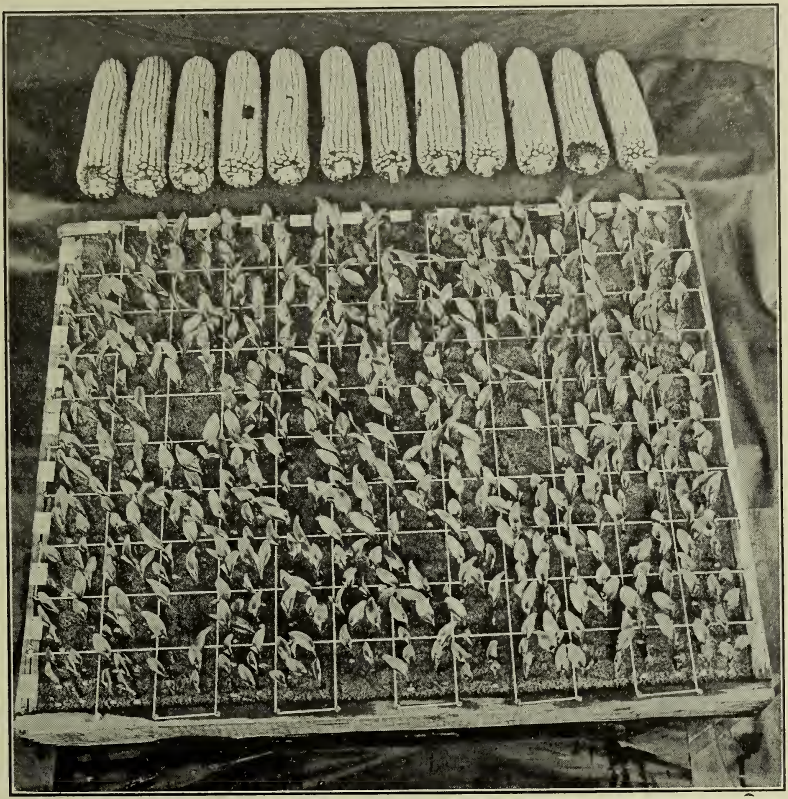
This method has been adopted by C. M. Long, agent for Pettis county, who has tested several hundred bushels of seed for farmers in that county. The method of handling the crate is essentially as follows:

The egg case or crate is turned on its side so that the fillers will slip in like drawers. A piece of sheet iron the same width as the fillers and two inches longer is used to put the fillers or drawers on while they are being filled with the corn. A paste board partition or bottom is put on this piece of sheet iron and the filler or sectional drawer is placed on the pasteboard. These sections are then filled about half full of moist warm sawdust which is tamped down in the section with a block made for the purpose. The six kernels are next taken from the ears which are labeled with small cardboards fastened into the butts with a small nail. Kernels taken from ear No. 1 are put in the left hand front compartment of the filler, grains from ear No. 2 in the second compartment of the front row, and so on. This process is repeated until the first row is filled, then by returning to the left hand edge of the filler and beginning on row No. 2 the process is repeated, and the entire filler or section may be filled without numbering more than the first square. (Page 1)

The sections are next filled nearly full of moist sawdust and again tamped down. This filler is then covered with another pasteboard. It is lifted while still on the metal and placed in its proper place in the egg case. The metal can be easily withdrawn from under the cardboard without disturbing any of the kernels or sawdust. It is also found very handy in removing the section. The work of filling the sections is continued until the egg case is filled. It will then contain kernels from 360 ears of corn or four bushels.

A tag should be tacked on the box to tell whose corn it contains and in case more than one man's corn is being tested a card can be placed in the section to show where the division is made. The front of the case is nailed loosely on and the box is then ready to be set away in a warm place to germinate. The test is ready to read in a week.

After the corn has had time to germinate the box is brought out and the front removed. The sheet of metal is then inserted between the piece of cardboard forming the bottom of the last section or drawer put in, and that piece forming the lid of the one which was next to the last. As each section or drawer has kernels from thirty-six ears, the kernels in the first square in this section will be from ear No. 325.



Sand Box Tester
Showing numbered ears from which kernels were removed for one row

As each section is removed the squares are torn up, no effort being made to keep either the sawdust or the pasteboard. By having a piece of paper before him the person can very rapidly note the ears which failed to make a good test.

There is as much danger of over heating the germinator and thereby injuring the grain to be tested as there is of allowing it to get too cold. The best temperature for successful germination of the cereals such as corn, wheat, oats, barley, and rye is what might be termed living room temperature or about 70 to 75 degrees Fahrenheit. Temperatures may run as high as 90 to 100 degrees for brief intervals without serious danger, but prolonged high temperatures are injurious. Corn seems to do best when the temperature varies somewhat as it does in the field. Four or five hours of rather high temperature, 80 to 85 degrees and then a gradual cooling until during the night the temperature reaches 60 degrees seems to give satisfactory results.

MAINTAINING TEMPERATURE DURING THE NIGHT

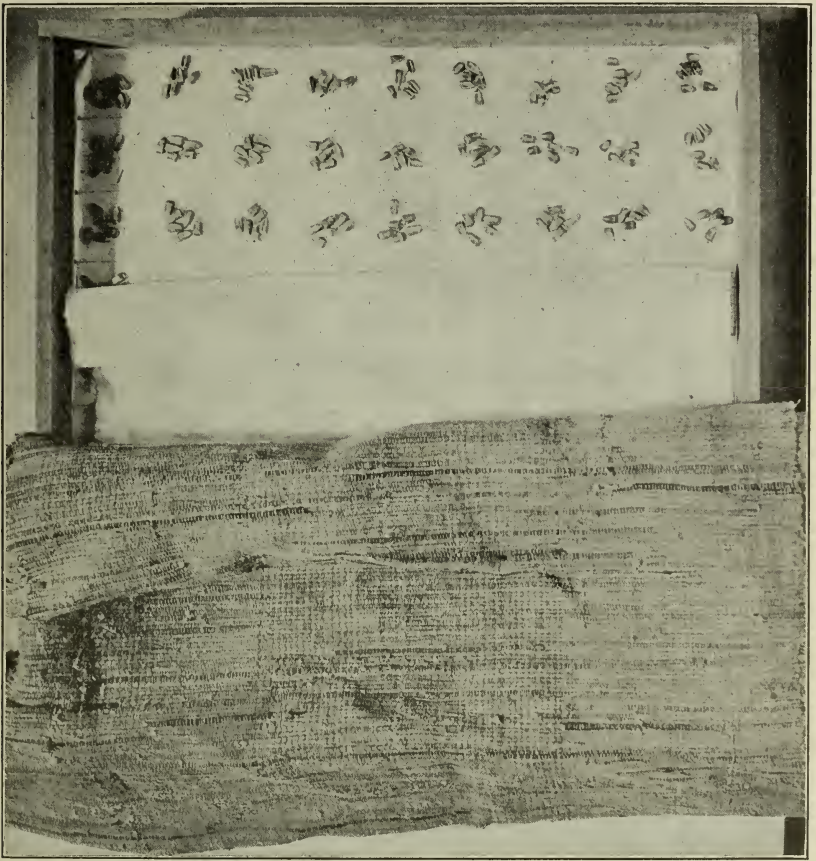
Where sand or sawdust box or rag doll is being used in a room or building where there is danger of chilling during the night, some effort should be made to keep the temperature up and prevent serious injury of the test. Where it is possible to watch the tester and make sure no trouble from fire is encountered, a lantern burning very low can be utilized to keep the tester warm. By inverting a large wood box over the germinator and the lantern, a temperature may be maintained which will not chill the seedlings. No lantern should be used unless it could be examined at frequent intervals during the evening and thereby run no risk from fire. If the lantern is used, the inverted box should be set up on bricks or blocks to permit free circulation of air.

Where germinators are used in school houses or other buildings where the heat is not maintained during the night and where no one has opportunity to examine it frequently during the late afternoon and evening, a hot plate of some sort should be used. Bricks or rocks which have been heated can be wrapped in cloths and then placed under the box to provide a warmer temperature than could be maintained otherwise. The hot bricks or stones should not come in direct contact with the germinator and thus cook the grain.

NUMBERING AND CARING FOR EARS AFTER SAMPLING

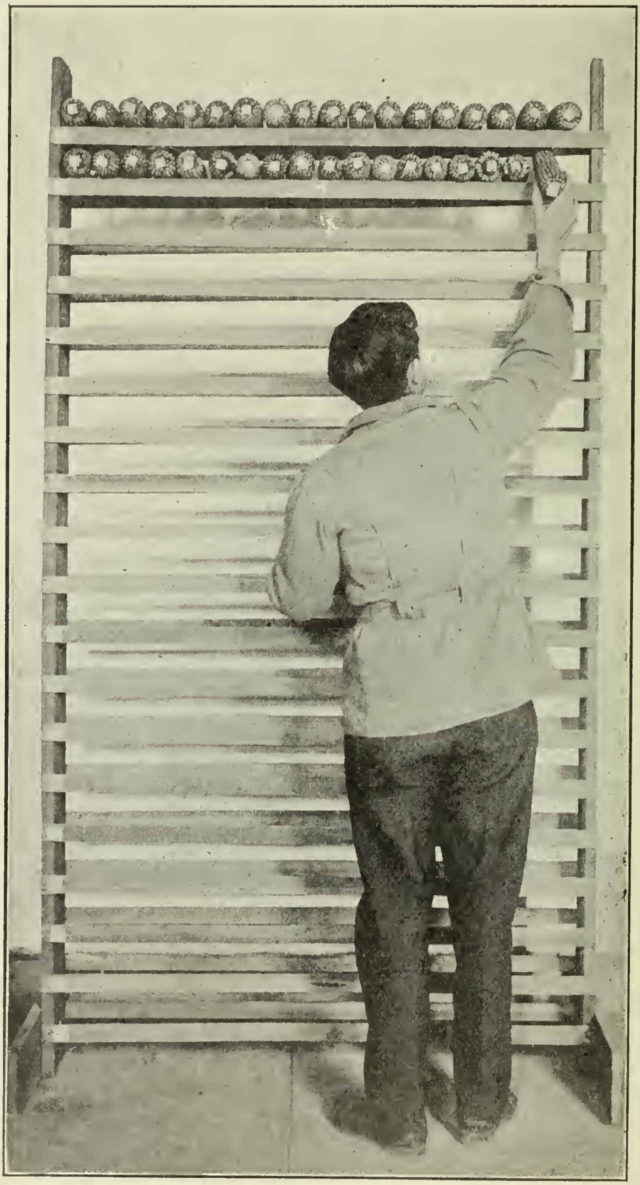
The germination test for corn, when it is to be made on individual ears, which is the only true test, requires a certain amount of bookkeeping and a more or less accurate system of numbering or labeling of the ears under test. Many different methods of numbering are practiced but perhaps the simplest is to place the numbers on a piece of cardboard and fasten them in the butt of the ear with a nail or pin, as shown on page 14.

As nearly representative samples as possible should be obtained from each ear to give it a fair chance. The kernels for the test should be as carefully taken as possible and should represent the different parts of the ear as accurately as the number of grains selected will permit. Where six grains are taken, only one should be taken from a given region or part of the ear. By turning the ear as illustrated on page 2 the sample will probably be as nearly representative as it is possible to get for a small number of kernels. In case ten kernels are used, two grains may be removed at each place, and this will permit selecting kernels from five different portions of the ear.



Sawdust Box Tester
Showing cloth over kernels and covering of carpet to hold moisture

Every ear from which the kernels have been removed should be labeled and placed away where it can be readily referred to when the test is ready to read and be either saved as a high germinating ear or discarded as one which would not grow well.



Storage Rack

Ears are numbered and stored here awaiting result of test

The rack shown on this page is one of the simplest that can be made for storing the ears during the test. It will be noted in this case that each row will accommodate eighteen ears of corn. By referring to the illustration on page 13 it will be noticed that the box shown holds nine ears per row. Thus one row on the rack will hold the ears from two rows in this sawdust box tester.

It is not necessary to label all ears as shown on preceding page if the same number of ears are placed on each row. In the case shown (18 ears per row) Ear No. 1, No. 19, No. 37, etc., are the first ears on the extreme left of rows 1, 2 and 3 respectively. By tacking a piece of cardboard or paper with the correct number on it, for the first ear in each row at the left edge, as shown in the illustration, each individual ear need not be numbered. However, the ears on the rack can be numbered to correspond to the number of the square in the tester, and any ear can thus be very easily identified with its sample of kernels.

The rack shown is made of 1 x 6 inch boards for uprights or ends and ordinary plastering lath, nailed horizontally, on which are placed the ears. These racks may be made of any convenient size, the one shown being large enough to hold 342 ears or nearly four bushels.

INTERPRETING THE TEST

The kernels, if given favorable conditions for growth, should begin to show sprouts freely on the third day. This is too early to estimate accurately the vitality of the seed, and the final reading should not be made before the sixth or seventh day. This will usually allow the first stems or sprouts to become an inch or more long. The reading of a test is the most painstaking part of the whole operation, if it is done accurately. Kernels will be found in all stages of germination and the efficiency of the test depends in no small degree upon the accuracy of this reading.

Where six kernels have been taken from an ear, the test should show six healthy sprouts of equal stockiness and vigor. If one kernel fails to grow, the ear should not be used as first class seed but should be placed in the reserve for use in case it is impossible to obtain better seed. If more than one kernel fails to produce a good healthy sprout, this ear should be permanently discarded as unfit for seed.

There will be cases where all six kernels finally succeed in producing sprouts but when they delay sprouting, the ear should be discarded. This sort of ear is worse than a dead one, since the dead one can be recognized readily, but the slow, weakly germinating ear, if planted, would, under the most favorable conditions, produce a poor, weak stalk. Another dangerous sort of ear to use would be the one which has six sprouts, only four of which were vigorous. Such an ear should be discarded because these weak kernels would probably fail to sprout in the soil.

In selecting ears for planting as the result of a germination test, only those which show six perfect sprouts, strong, healthy, and vigorous, should be chosen. Weak and dead kernels mean a poor stand and a reduced yield.

FIVE REASONS FOR TESTING

1. The average Missouri farm has 25 acres of corn with an approximate stand of 72½ per cent. This means that on every Missouri farm there are 5.87 slacker acres in every 25 acres of corn.

2. By a germination test of every seed ear, a perfect stand as far as seed is concerned can be had. Allowing 12½ per cent decrease for unavoidable losses, wind, weather, and pests, a gain of 15 per cent of corn is still possible as a result of testing.

3. This additional 15 per cent of corn would mean approximately four and one-half bushels per acre. On the average farm this would mean 112 bushels.

4. It costs approximately five cents an acre to test each ear of seed corn.

5. Individual tests are absolutely necessary to attain maximum production.

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AGRICULTURAL
EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 49 COLUMBIA, MISSOURI MAY, 1918

Water Systems for Farm Homes

F. C. Fenton

No convenience adds more to the comfort and well being of the family on the farm than a good system of running water. After it has been in use for some time the farmer and his family usually wonder how they ever got along without it. Carrying water is hard, tiresome labor and usually must be done at the busiest time, when other work is most pressing.

A water system saves labor not only in the time required to carry water in from the well, but also by encouraging the use of more water and thus lightening the work in the house. Cleaning, scrubbing, and washing dishes become less burdensome, in fact, every operation in which water is used is made easier by having a plentiful supply. A water supply encourages the use of more water. Investigations have shown that in homes where all the water must be carried in by hand, each person uses from six to eight gallons per day for all purposes, while in houses which have a complete system of running water each person uses from twenty to thirty gallons. This increased use of water means easier work and improved sanitary conditions. Many farmers feel the need of a water system and realize its value, but think that it is too expensive. They are overlooking the fact that there is a successful and practical water system which is within the reach of every farmer. It need not be elaborate. In fact the simplest and cheapest systems are often the best. The farmer who waits until he is able to install an elaborate water system will go without the comforts of a simple system longer than is necessary.

This circular shows some of the systems, from the simplest to the most elaborate, by which running water may be had in the farm home. Every system shown herein has been in actual operation and has been found practical. Drawings and illustrations of each representative type are given, together with a description and explanation which will enable the farmer to choose the one best suited to his needs.

WATER SYSTEMS IN A COLD HOUSE

Many of our country homes are so poorly heated that the installation of an elaborate system of plumbing is not practicable. This should not prevent any one from putting in a simple water supply system. A water supply which can be protected from freezing or drained without excessive labor is practical in any house, whether it is heated or not. Every water system should, of course, have provision for draining out in cold weather, or in emergencies. A drain pipe with a cock at the lowest point in the system is the usual method. The first three systems shown in this circular are well suited to a house in which water freezes every night in the winter.

ESTIMATING THE CAPACITY OF A SYSTEM

The amount of water needed daily must be known before a water system can be intelligently planned. This may be figured upon the following basis: For each person in the house, twenty-five gallons a day should be supplied where conveniences of toilet and bath are in use. Horses require seven gallons a day; cows, six gallons a day; sheep and hogs, two gallons a day. The storage capacity necessary for reserve supply depends upon the power used to pump the water. If a windmill is used, storage for a five-day supply should be provided. If a gasoline engine is used for pumping, a two-day supply is sufficient. For house use, where the pumping is done by hand, a one-day supply may be large enough if the water is pumped each morning.

TYPES OF WATER SYSTEMS

The simplest way.—The simplest kind of water supply in which a pitcher or force pump is attached to the sink in the kitchen as shown in Fig. 1, is a great improvement over carrying the water by hand. The pipe is extended thru the floor and wall into the cistern. Whenever water is wanted it can be pumped directly to the sink. A drain must be provided to take away the waste water. The cistern should be close to the house and it should be remembered that a lift of more than twenty feet is not practical with a common cistern pump. This kind of water system needs no protection from freezing. On cold nights the pump handle may be lifted and the water allowed to run back into the cistern.

Hot and cold water in the kitchen.—A cheap and simple method of having hot and cold water for the kitchen is shown in Fig. 2. An

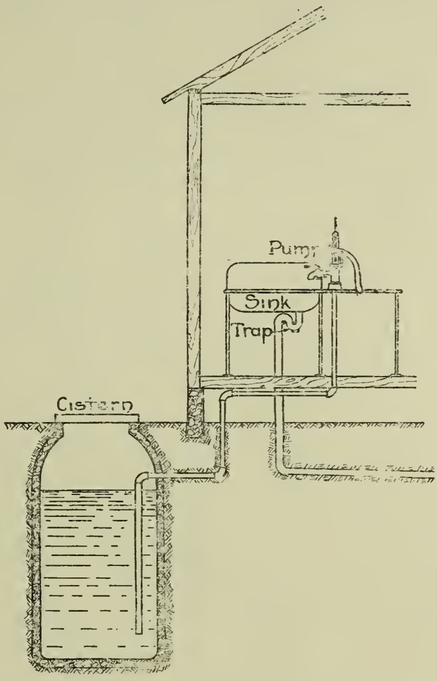

Fig. 1.—The simplest form of water system

ordinary kitchen force pump is connected to the cistern by a one and one-quarter-inch pipe. Three-quarter-inch galvanized pipe is used from the pump to the range boiler, and the stove is connected as shown in the drawing.

The bottom of the boiler should be set on a pedestal so that it will be about level with the top of the kitchen sink. This will permit better circulation thru the heating coils so that the water will heat faster and also make it posible to draw nearly all of the water out of the tank without pumping. There is no valve at the pump spout. The water in the tank is allowed to expand, when heated, thru this open spout.

This water system provides cold water from the cistern or shallow well, hot water from the top of the range boiler, and warm water from the bottom of the range boiler. The operation of the system may best

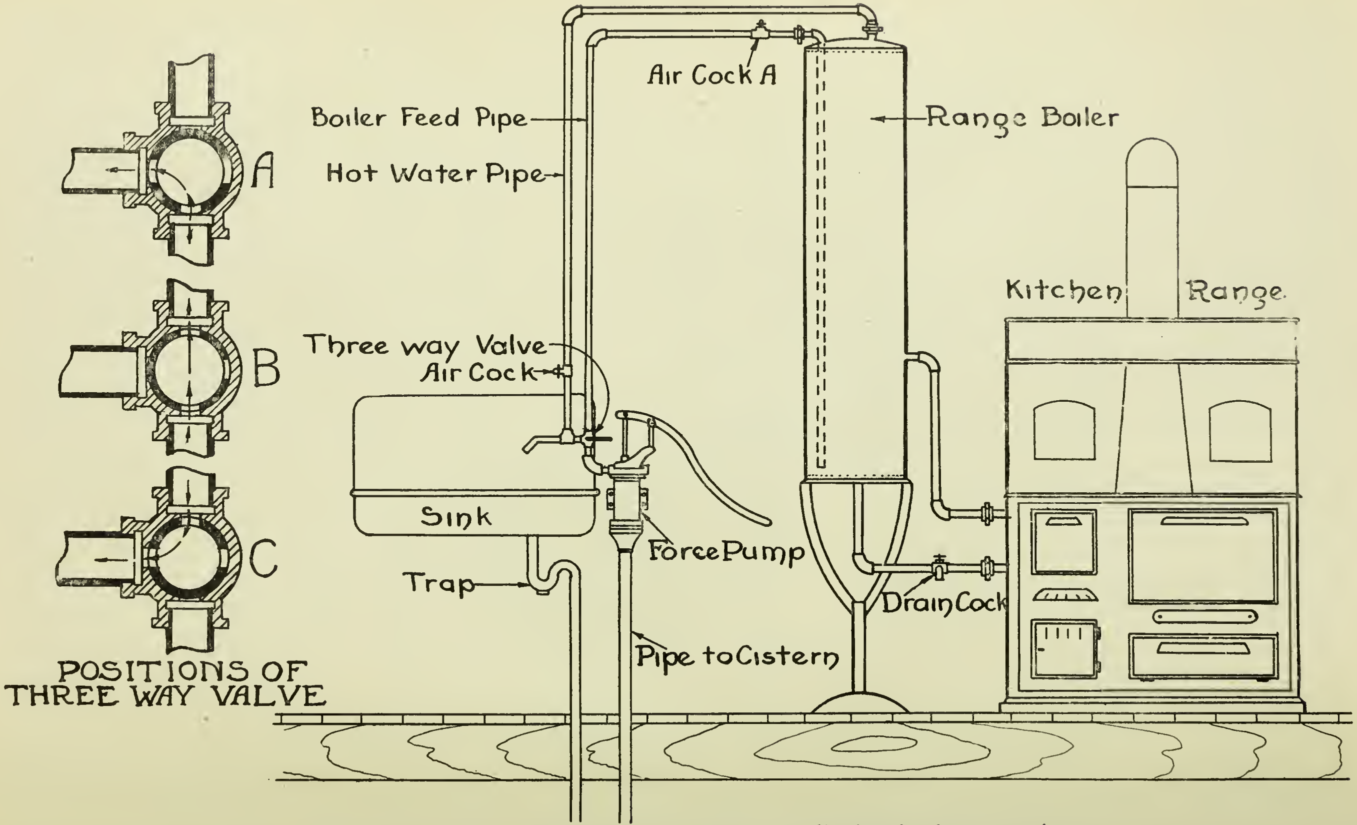

Fig. 2.—Cold, warm, or hot water may be drawn by adjusting the three-way valve

be understood by studying the three-way valve which is placed just above the pump, the different positions of which are shown on the left side of the drawing.

For cold water.—The valve is placed in position A, with the upper opening closed and the other two open. By operating the pump, cold water is pumped directly from the cistern into the sink. In this position it is nothing more than a pitcher-pump like the first system shown.

For hot water.—The valve is placed in position B, with the upper and lower ports open. In this position hot water is obtained from the top of the tank by forcing cold water into the lower part. The pump must be operated and the tank must be full before any hot water will come out.

For warm water.—The valve is placed in position C, with the lower opening closed. In this position the water will siphon back into the sink without pumping if the air cock on the hot water pipe is opened. If the boiler is placed high enough, nearly all of the water can be siphoned out in this manner, without pumping. In very cold weather or if the house is to be left unwarmed, the water may all be drained out of the tank by placing the three-way valve in position B, and raising the pump handle. The water will then run back into the cistern, except a small amount in the bottom of the tank which can be drained by opening the boiler drain cock. Ordinarily there is little danger of the water in the tank freezing. The water can be drained out of the pipes alone by opening the air cock A, and raising the pump handle. This will eliminate the work of pumping up another tank of water in the morning.

Simplicity is the main feature of this system. Any kind of force pump or range boiler may be used. All other parts of this equipment are carried by all plumbing supply houses. The addition of other fixtures will not affect the use of this system. A bath tub may be placed in the next room, and be supplied directly with water from this pump. The entire equipment is movable and the tenant who would rather furnish his own water system than go without can move these fixtures and set them up in another house.

Elevated tanks.—A very common method of obtaining running water is by the elevated tank. These tanks may be placed in the attic of the house, on an elevated tower outside, or on a hill which is higher than the adjoining buildings. All elevated tank systems are based on the simple principle that if water is pumped to an elevation it is sure to run down again when given the chance.

Simple attic tank.—Fig. 3 shows a simple water system which makes use of the cistern supply and a barrel placed in the room above the kitchen. A better grade of steel tank may be used. A float should be placed on top of the water in the tank, and connected by a cord running over a pulley to a guage in the kitchen. This will indicate just how much water is in the tank at all times. A hand force pump, such as is shown in the drawing is much more satisfactory for this kind of system. It pumps water so fast that the time spent in pumping each day is very small. In cold winter nights the tank may be drained, or if some fresh, warm water is pumped into the tank in the evening very little trouble from freezing is likely to follow.

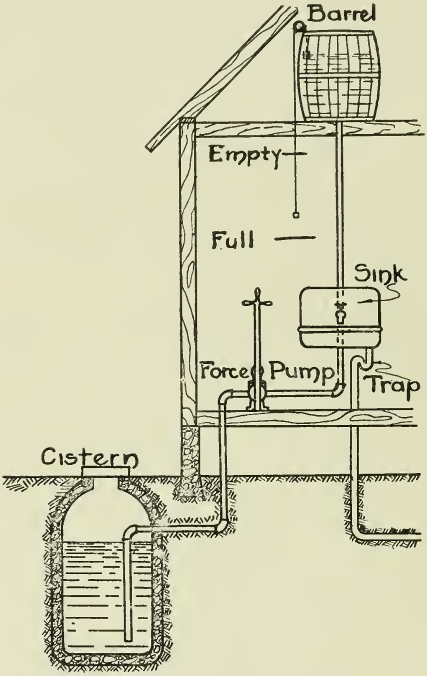

Fig. 3.—The simple attic tank system

Improved attic tank.—A simple yet efficient system which is in use on the Hall Farm at Lamonte, Missouri, is shown in Fig. 4. A small, galvanized iron tank of sixty gallons capacity is placed in the attic of the house. Water is pumped to this tank by the gasoline engine at the well, which is located about 75 feet away. A return pipe from this tank to the stock tank in the yard takes care of the surplus water. All water used is pumped thru the attic tank, thus insuring a fresh, cool supply. The attic tank is connected to the kitchen sink and also to a range boiler. Other fixtures, such as bath tub and toilet, may be connected also. The tank and pipes are protected from freezing by enclosing them in a square wooden box, packed with sawdust. This system overcomes most of the objections to the attic tank. Water from an attic tank usually becomes warm very quickly, but by pumping so much water thru the tank it is kept cool and fresh. Then, a large tank is not necessary, and many houses are not built to support a great weight in the attic.

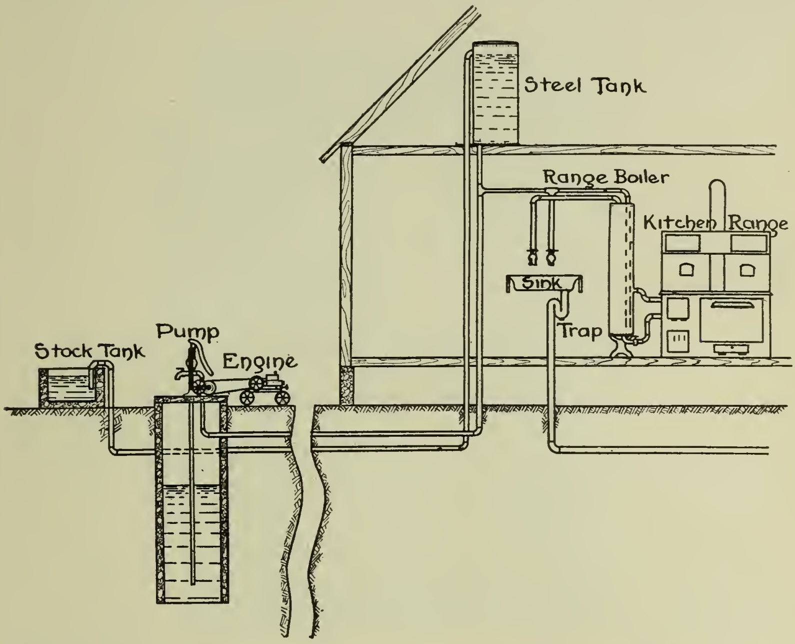

Fig. 4.—The improved attic tank system is supplied with water by a gasoline engine

The concrete reservoir.—The farmer who has some ground near his buildings, which is higher than the buildings, should build a concrete reservoir. The water can be pumped up to this reservoir and allowed to run down to points where it is to be used. The ground need not be as high as is generally supposed. If the water in the tank is fifteen feet above the highest faucet in the house there will be ample flow. Sometimes, in order to secure this elevation the tank is built on top of the ground, and the dirt scraped up around it to prevent freezing. A plan for this system is shown in Fig. 5.

The best feature of this system is its absolute reliability. There is nothing to get out of order; no machinery, to keep in running order. It would probably demand less care and attention than any other water supply system. If the pipes are laid carefully, three feet deep, no trouble from freezing will be had. Since the tank is laid under the ground, the water is kept cool and fresh, and is easily protected from contamination. Another point in favor of this system is its comparative low cost. Expense for the concrete reservoir and enough pipe to connect it with the well and buildings is all that is necessary. The farmer can usually do most of the work of constructing the reservoir himself. These reservoirs are usually built in the shape of a rectangular vault rather than round, like most cisterns. If the ground is excavated carefully no outside forms will be needed. In some soils a cement mortar is plastered on the walls and a very cheap tank is made. The one objection to this system is that on many farms the buildings are on the highest point of ground, and such a system is impossible.

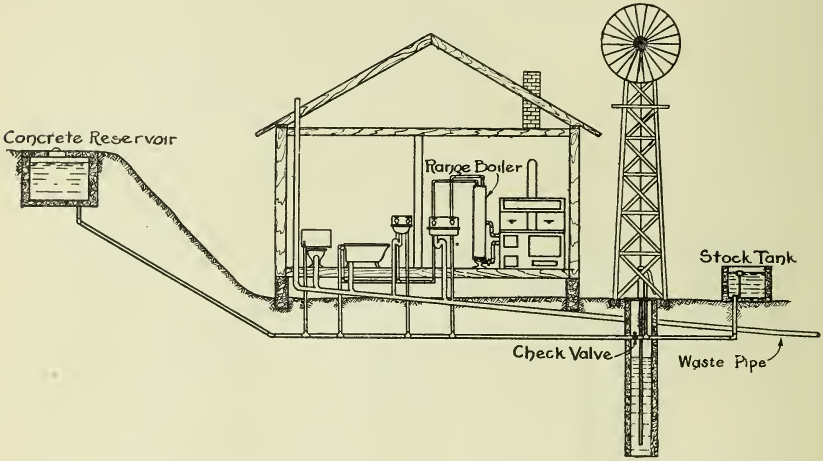

Fig. 5.—The concrete reservoir system is one of the most reliable if sufficient elevation is available

Elevated tank on a tower.—A steel or wooden tank, supported by a tower is commonly used to secure water pressure. Where this system is used the tank is often placed high enough to give a pressure sufficient to fight fire. The greatest problem of the elevated tank is to keep the pipes from freezing. The water becomes warm and stagnant in summer and freezes in winter. The cost of an elevated tank with the tower is quite high, and the up-keep expense is also likely to be considerable. Fig. 6 shows an elevated tank with the tower enclosed with siding to make room for storage below. This helps to protect the pipes and tank from freezing and also improves the appearance of the tank.

Pressure tanks.—In this system the water is stored in an air-tight steel tank from which it is forced thru the pipes. The principle upon which it works is shown in Fig. 7. When the water is pumped into the bottom of the tank the air which is already there is compressed and exerts a back pressure on the water. This air pressure forces the water thru the outlet pipe which is placed in the bottom of the tank. In the beginning the tank is full of air at atmospheric pressure, but as the water is pumped in this pressure increases to 25 to 40 pounds per square inch. Then, as the water is used from the tank the pressure is rapidly reduced. Ten pounds is usually the least working pressure that is practical. Tanks do not deliver their total capacity, in fact, only slightly more than one-half their total capacity may be utilized. This fact must be kept in mind when deciding upon the size of tank to purchase. Do not buy a tank which is too small.

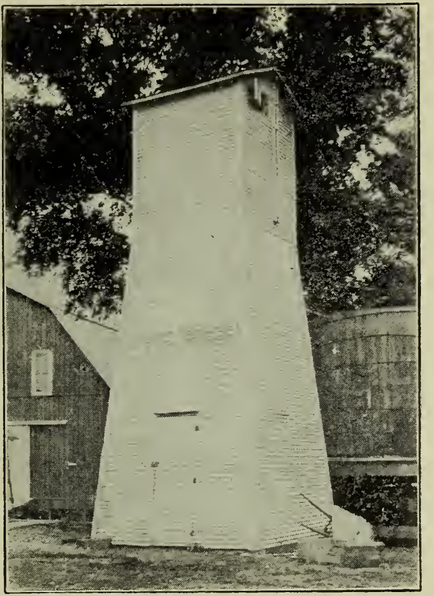

Fig. 6.—The tower supports the tank, protects the tank and pipes, and provides storage room below

When the air stands under pressure for long periods some of it is absorbed by the water. This further reduces the pressure and also the amount of water which the tank will deliver. A tank is said to be water-logged when the air has been absorbed and the pressure falls off quickly as water is drawn out. To remedy this condition some additional air must be pumped in. This air may be introduced automatically by the water pump, which pumps a small amount of air with each stroke, or the air may be put in with a separate pump. The total

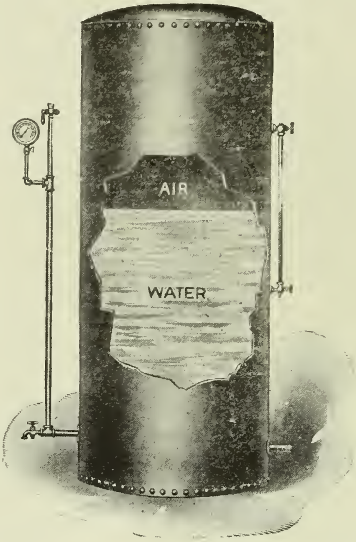

Fig. 7.—Compressed air in the tank forces water thru the pressure tank system

SIZES AND CAPACITIES OF PNEUMATIC TANKS

Size of Tank		Total Capacity in Gallons	Working Capacity in Gallons	Approximate Cost
Diameter Inches	Length Feet			
24	6	140	95	$50
24	8	190	130	60
30	6	220	145	60
30	8	295	200	74
30	10	365	245	83
36	6	240	160	64
36	8	315	210	76
36	10	420	280	94
36	12	525	350	107
42	10	720	480	156
42	14	1,000	665	194
48	12	1,130	780	239
48	18	1,700	1150	348

equipment for this kind of water system consists of an air-tight steel tank, a force-pump, and necessary piping and plumbing fixtures.

The pump may be operated by hand, as shown in Fig. 8, and this makes a suitable system for use in a small residence where the amount of water used is not large. It is especially suited for a soft water supply. Fig. 9 shows a larger system where a large tank is used and where house and barns are supplied with water. In this case the pump should be operated by a windmill or a gasoline engine. The pressure tank makes a very reliable water supply system. The tank can be put down in the basement, or buried in the ground near the windmill, where the water will be kept cool. Pressure tanks are better adapted for house supply than for the entire farmstead. The amount of water used by livestock and the family would require so large a tank that the expense would be heavy. It requires some little attention to operate a pressure tank, but with this attention it affords a very satisfactory water supply.

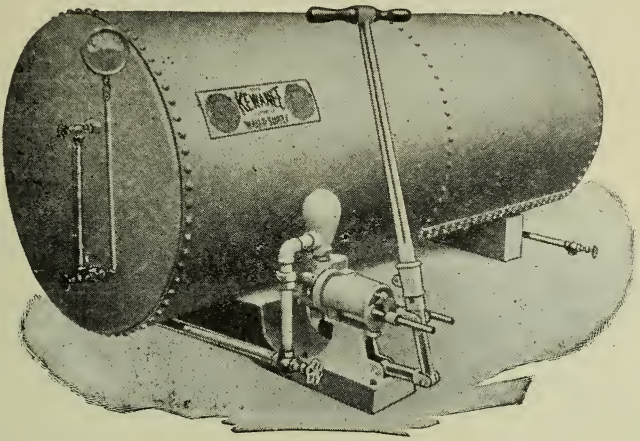

Fig. 8.—The horizontal pressure tank which is charged by a hand force pump

Auto-pneumatic or fresh water system.—The essential features of this water system are shown in Fig. 10. A supply of compressed air is held in a steel tank. From this tank the air is piped to an automatic pump which is submerged in the well. The compressed air operates the pump, forcing the water thru the pipes to the faucets. The pump operates only when the faucet is opened and water wanted. The following parts are necessary to the complete installation: An engine or motor, an air compressor, air tank, special automatic pump, air trap, gauges, and piping. The illustration shows equipment for furnishing both hard and soft water with one installation.

This system is ideal in some respects. It takes water directly from the well and delivers it at the faucet. No storage is necessary.

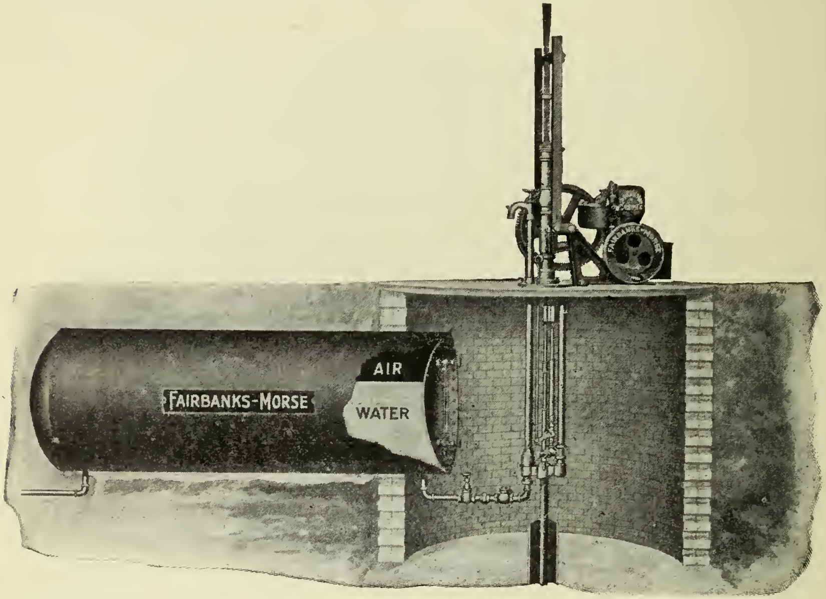

Fig. 9.—Power may be used in operating the pressure tank system where house and barns are to be supplied with water

It is possible to operate two or more pumps from one air tank, thus furnishing soft as well as hard water. The objections to this system seem to be the complex and expensive pump which is used. This makes an expensive system and one which may get out of order. It is not adapted to all wells. There must be a clear, plentiful supply of water without sand or grit. The well must furnish a never failing supply of water because it is necessary to have at least six feet of water above the pump to make it work properly. Water cannot be lifted economically to heights above 100 feet.

Many such systems have been in operation for years and are giving excellent satisfaction, while others have given considerable trouble. Taking everything into consideration, it cannot be considered as reliable as some of the other systems.

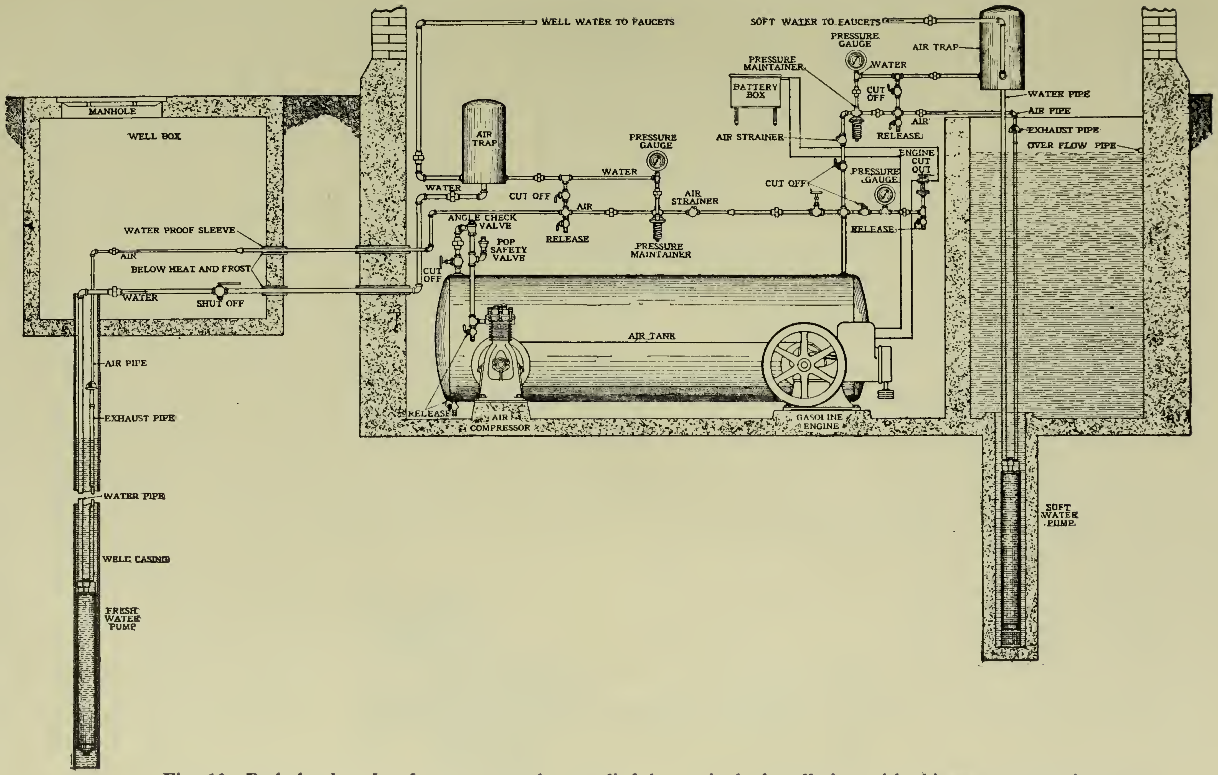

Fig. 10—Both hard and soft water may be supplied by a single installation with this auto-pneumatic system

POWER FOR PUMPING WATER

The installation of a water system usually calls for some kind of power for pumping. Hand pumping while satisfactory for a small house supply, soon becomes tiresome when very much water is to be pumped. A gas engine rated at ¾ to 1½ horse power is the usual size required for pumping. A large engine may be used for this and for other purposes besides pumping. A pump jack like the one shown in Fig. 11 is in common use. The engine is a very reliable source of power and is becoming more popular each year. Kerosene engines are satisfactory and they cheapen the cost of operation. A comparison between gas engine power and hand power for pumping water is overwhelmingly in favor of the gas engine. A gas engine will furnish power at the rate of from 2 to 4 cents per horse power hour, while human labor costs from $1 to $2 per horse power hour.

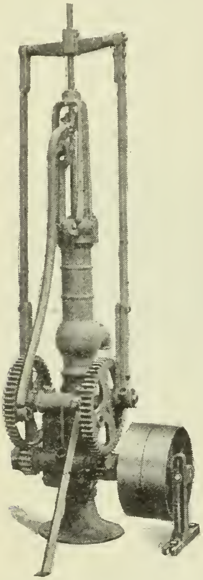

Fig 11.—A pump jack

The windmill furnishes a cheap source of power for pumping. The first cost is considerable, but if the mill is well taken care of it will last a long time. The wind can be depended upon in most localities to furnish a constant source of power.

The hydraulic ram.—Where a spring or a small stream is used as a source of water the hydraulic ram offers a cheap, simple and efficient device for pumping the water. The advantages of the ram are: 1. It works continuously without attention. 2. Its first cost is low and it lasts for many years with very little expense for repairs. 3. It will force water to a great height and thru a long pipe.

The hydraulic ram uses the momentum of falling water to force a small portion of that water to a greater height. The method of operation may be understood by referring to the Fig. 12. The water from the spring flows down the drive pipe A and flows out thru the waste valve B. The velocity of this water gradually increases until the pressure on the bottom of the valve causes it to rise and close. The moving column of water in the drive pipe exerts a pressure sufficient to open the valve C into the air chamber. The air in this chamber is compressed until the energy of the moving column of water in the drive pipe has spent itself and the water comes to a stop. At this instant the pressure on the bottom of the valve B is decreased sufficiently to allow it to drop down and the water to start flowing thru it again. Flow past the waste valve will continue until there is sufficient force to close the valve, then the previously described action is repeated. A small amount of water is forced into the chamber D and thence thru the discharge pipe to the storage tank, while the remainder of the water escapes thru the valve B and is wasted.

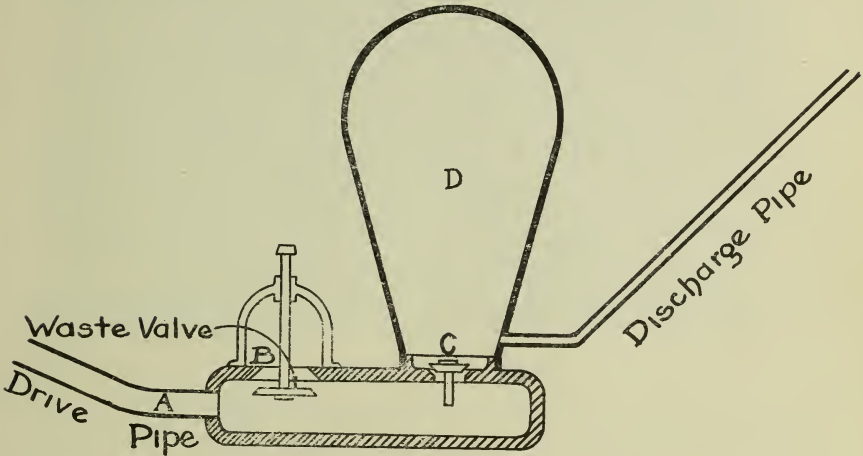

Fig. 12.—Cross section of hydraulic ram, showing method of operation

Fig. 13 shows a typical installation of a ram. The spring is shown on the right, walled in to protect it and to insure that the water will run into the supply pipe. The ram is set down in a pit preferably of concrete, where it can be covered and protected from frost in the winter. The supply pipe leading from the ram to the stock tank on the hill shows clearly what the ram is doing. When a ram is to be put in, the first thing to consider is the supply of water and the fall available. There should be at least 2 gallons per minute flow and a fall of 18 inches from the spring to the ram. A larger flow of water and a greater fall simply mean that more water can be elevated and to a greater height. A spring or stream which will furnish 4 gallons per minute will usually be found sufficient for ordinary farm house uses. It is common to find a ram in which from one-tenth to one-fifth of the water is delivered. One company gives the following rule to compute the water delivered by their ram. Multiply the number of gallons per minute available to supply the ram by the number of feet fall from spring to the ram. Divide this by 1½ times the height in feet to which the water is to be delivered, and the result will be the gallons per minute which the ram will deliver.

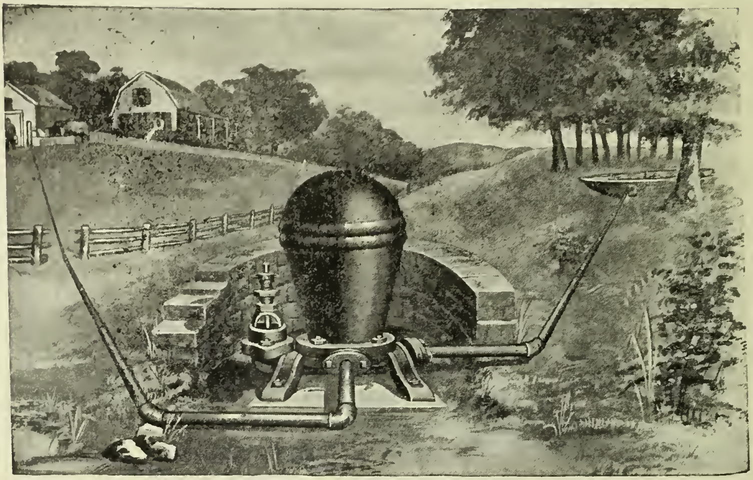

Fig. 13.—Typical installation of hydraulic ram

The table below gives the requirement and prices for common sized rams:

Amount of water furnished to ram per minute	Length the drive pipe should be	Size of pipe		Price
		Drive	Discharge	
2 gallons	12 to 50 ft.	¾ in.	½ in.	$9.75
2 - 4 gallons	12 to 50 ft.	1 in.	½ in.	12.00
3 - 7 gallons	12 to 50 ft.	1½ in.	¾ in.	15.00
6 - 14 gallons	25 to 100 ft.	2 in.	1 in.	24.00
12 - 25 gallons	25 to 100 ft.	2½ in.	1¼ in.	43.00
20 - 60 gallons	25 to 125 ft.	4 in.	2 in.	81.00

When a hydraulic ram is to be purchased the following information should be sent to the company:

1. Flow of water in gallons per minute.
2. Distance between source of supply and the place suitable for location of ram.
3. Fall between spring and the ram.
4. Height to which water is to be raised.
5. Length of pipe from ram to tank where water is delivered.

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UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

AGRICULTURAL
EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 50 COLUMBIA, MISSOURI MAY, 1918

Cottage Cheesemaking

L. G. Rinkle

Cottage cheese is a valuable human food. It is an excellent substitute for meats since it contains a high protein and energy value. The United States Department of Agriculture states that "In every pound of cottage cheese there is about one-fifth of a pound of protein, nearly all of which is digestible. Meats, on the other hand, usually contain less protein and besides have a certain waste, such as bone and other inedible material." Cottage cheese does not contain quite so much energy producing material as meats but nevertheless supplies that energy much cheaper than meats.

The United States Department of Agriculture also makes the statement that "thru lack of proper utilization of skim milk for human food, more food energy is wasted annually than the total food value of all the meat produced in the United States." As cottage cheese is made from skim milk, large quantities of this food material could be saved.

Palatable product necessary.—There are two primary reasons why cottage cheese is not used in large quantities. The first of these is the lack of uniformity in the quality of the cheese. The consumer demands a uniform grade of food. The lack of such uniformity discourages consumption. A visit to the large markets would soon convince one that cottage cheese of an ideal mild flavor and even texture is difficult to find. The cause for this lack of quality is largely due to the ignorance of proper methods of manufacture. The farmer often thinks that a cottage cheese which suits his taste will suit that of the consumer. It must be remembered that the city buyer is frequently critical, and the maker of cottage cheese must cater to the customer's appetite and taste rather than to his own.

Another reason for the limited consumption of cottage cheese is the lack of knowledge of the various ways in which it can be served. The average consumer eats his cheese served plain. When cheese is served without further preparation some persons find it very difficult to digest. It has been found that when the cheese is finely divided as when mixed with other foods this objection is largely removed. Many appetizing dishes may be prepared that would greatly increase its use. It may be served in various salads, made into cheese cakes or pies, used with sandwiches and in many other foods. Many ways of serving cheese may be found in Farmers' Bulletin 487 of the United States Department of Agriculture. The Home Economics Department of the University of Missouri at Columbia will be glad to furnish recipes for the use of cheese in many delicious ways.

The making of small quantities of cheese will require very little time and trouble. No extra equipment outside that found in the average farmhouse kitchen is necessary. A definite procedure must be followed, however, if a good quality is to result. It should be remembered that the directions given herein will apply under average circumstances, and that it may be necessary to change them slightly to fit certain conditions. The necessity for such changes will be recognized only after some experience in making the cheese.

Method of making.—To make cottage cheese, whether in large or small quantities, it is essential that good skim milk be used. In the production and handling of the milk clean methods should be practised. All the milk vessels, including the cream separators, should be thoroly cleaned before using as dirty utensils may contaminate the milk and cause bad flavors that will cause a poor quality cheese. The skim milk should be obtained as soon after it comes from the separator as possible. It will then be fresh and sweet.

The milk should be placed in a vessel and brought to a temperature of 70 degrees Fahrenheit at once. It is necessary to have the milk stand at this temperature to get a perfect sour curd. If the temperature is kept lower than 70 degrees F., souring will be delayed several hours and bad flavors will result. On the other hand, if the temperature is higher than 70 degrees F., the curd will form rapidly which will result in a sour, dry, poorly flavored cheese. After the vessel of milk has been brought to a temperature of 70 degrees F. it should be maintained at that temperature. This may be done by placing it in a tub or pan of water of the same temperature. The larger volume of water will help to hold the milk at a uniform temperature as the larger quantity of liquid will change temperature more slowly. It will be necessary to use a dairy thermometer so that temperatures may be regulated.

The souring of milk causes it to coagulate. When fresh skim milk is brought to a temperature of 70 degrees F. it should sour rapidly and coagulate in 18 to 24 hours. As soon as a smooth curd has formed it is ready to be heated. Heating should not begin, however, until the curd has become solid. If the curd is heated too quickly after it begins to form, that is, while it is still flakey, difficulty may be experienced in getting it to drain properly. On the other hand, if the heating is delayed for some time after a solid curd has formed, the cheese will be extremely sour and dry. The proper condition of the curd at the time of heating can best be ascertained by experience in making the cheese.

Heating the curd.—The cheese curd should be heated slowly. This can be done by placing the vessel of curd over a very slow fire or by immersing it in a vessel of warm water, thus making a double boiler. In the latter case the water should be heated slowly. The curd should be heated to a temperature of 95 degrees F. and held for about 15 minutes. To insure uniform heating, the curd should be gently stirred with a dipper or ladle. Vigorous stirring should be avoided as the curd will be broken into fine particles. This interferes with proper draining. When heated for the required length of time the curd should be drained.

An extra heavy quality of cheese cloth in which to drain the curd may be used. Sugar or salt sacking will answer the purpose. The cloth should be cut in the shape of a square and carefully laid over a milk strainer, or a collander, allowing the edges of the strainer cloth to project over the side a few inches. The curd is then run into the strainer cloth. Part of the whey will pass thru immediately. When the cloth has been well filled, the opposite corners should be tied together. This forms a sack that may be hung up to drain. It may be necessary to make two or three drain sacks in this manner, depending upon the amount of cheese that is to be made.

The cheese curd will rapidly develop an extremely sour taste if it is allowed to remain in the whey for a long time. It is therefore important that the whey be removed as soon as possible. This may be accomplished by rolling the curd back and forth by alternately raising and lowering one side of the drain sack. Draining should not be hastened by twisting or squeezing the drain sack as this will produce hard dry lumps of cheese. Fine particles of curd may also ooze thru the cloths and be lost in this way. Sometimes the curd is cooked at a high temperature so that the whey will drain off quickly. This should be avoided as a high temperature will result in a tough, dry, coarse grained cheese.

Flavoring the cheese.—After draining, the curd is ready to be salted. The proper degree of draining is judged by the consistency of the curd. At this stage the curd should be somewhat pasty, but not dry. This can best be ascertained by experience. The amount of salt to use is about one ounce for each pint or pound of curd. It is best to use a fine table or butter salt for this purpose. The salt should be thoroly mixed thruout the curd by means of a large spoon or ladle.

Cheese is sometimes made more palatable by adding small quantities of cream. Ground pimentos, peppers, or other ingredients may also be used for the same purpose. This is largely a matter of personal taste, however, and should be left to the consumer's desire.

If a good quality of cheese is produced, large quantities of it may be sold in the cities. Special containers will often assist in such sales. There are various types of fiber packages that may be used. They range in size from about four ounces to five pounds and can be purchased thru practically any dairy supply house. The cheese when put up in such packages usually retails at 15 cents a pound.

Another method of making cottage cheese.—The following method for making cottage cheese will give a somewhat milder flavor and smoother textured cheese than the preceding method. It also shortens the time of making to some extent and does away with heating the curd.

To make cottage cheese by this method, rennet extract or junket tablets are used. The extract can be obtained from any dairy supply house while practically any city druggist handles the junket tablets.

A good sweet skim milk should be used. It should be brought to a temperature of 70 degrees Fahrenheit and one-half of a teacupful of sour clabber added. The clabber should have been prepared by setting some skim milk 24 hours previously at a temperature of 70 degrees F. and letting it sour naturally. To get the clabber in the right condition the temperature of 70 degrees is important. After adding the clabber, the rennet or junket is added. In using the rennet extract, add three drops to a teaspoonful of cold water for each gallon of milk. If the junket tablets are to be used, one of them should be dissolved in a teacupful of cold water and one tablespoonful of this mixture added to each gallon of milk.

The milk will form a curd in 10 to 15 hours. As soon as whey begins to appear in the vessel of curd, the curd should be drained. This can be done without heating. Place the curd in a cotton sack, such as a sugar sack, and allow it to drain for a few minutes. The sack should then be placed on a flat surface, a board placed over its top and pressure applied by means of weights. Three or four heavy bricks or a bucket partially filled with water will serve the purpose. Care should be exercised to avoid pressing the curd too long, since this makes it very dry. When the curd is of the proper consistency salt should be added as described under the preceding method.

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A. J. Meyer, Director

CIRCULAR 51 COLUMBIA, MISSOURI MAY, 1918

Selection and Management of the Dairy Bull

C. H. Eckles

The economical production of milk is possible only when the machine used, the cow, is an efficient one for the purpose and when the person in charge knows how to manage the machine. A cow is born with a certain natural ability to produce milk if given proper conditions. The extent of this ability is mostly a matter of heredity or breeding. The high producing dairy cow is not the result of any special manner of raising the heifer calf. The most skilled feeder cannot put this quality into a cow born without it. All the good feeder can do is to make full use of the ability to produce milk which the cow has inherited. The extent to which this milk producing ability is inherited varies greatly as is well known. Even in the well bred dairy herds not all the heifers raised prove good enough to retain in the herd. Constant culling of the inferior cows has been found one of the most important measures in maintaining a profitable herd.

The ability to produce milk is inherited thru both dam and sire, but since the sire is responsible for half the inheritance of each young animal, he is clearly the most important factor in improving the herd. If the cows in a herd are capable of producing only 200 pounds of fat a year and the sire used represents a breed or family, the cows of which average 350 pounds of fat a year, it would appear reasonable that the heifers would average half way between, an increase of 75 pounds of fat a year.

The increase by using a good sire is often much more than this.

The first five daughters of the bull, Sultana's Virginia Lad, owned by the University of Missouri averaged 511 pounds of fat in a year as two-year-olds while their dams at the same age averaged 274. This was an increase of 86 per cent in fat and 76 per cent in milk over the dams. The daughters of another Jersey bull used in the University herd averaged 198 pounds of fat a year from cows averaging 269 pounds a year, a decrease of 26 per cent.

How a dairy bull is selected.—The selection of a diary bull is generally made upon one or more of four points: (1) breed, (2) type or appearance, (3) pedigree, that is breeding behind him, (4) character of offspring. Naturally in many cases more than one of these points are taken into account, for example breed, pedigree, and individuality.

Breed.—The bull should be a purebred of the breed to which the cows belong or, in case grading up has just begun, of the breed selected as the one to be used in the future. Cross breeding is justified only when making the first steps toward grading up a herd and when cows of mixed breeding are on hand. .Crossing breeds with the expectation of getting better results by that method is a great mistake. Breeds have been developed and kept pure in order that certain characters may become fixed so strongly that they will be transmitted regularly.

The leading dairy breeds represent the best efforts of breeders for generations. Certainly it is poor judgment not to make use of what has been done in the past. Greatest progress can be made by starting with a pure breed where the breeders of the past have left off. However, selecting by breed alone is not sufficient for the best results, and the man who buys a bull needs to take other things into account including pedigree, type, and when possible, the characteristics of his daughters.

Type or appearance.—The tendency is probably to attach too much importance to the type or appearance of the bull. If the appearance of a bull were a safe guide as to what he would transmit, then he could be selected on this basis. However, the best breeders admit that the appearance of the bull offers little in the way of a basis for judging how he will transmit dairy qualities. It seems that the looks of a bull is more of a guide as to the type or appearance of his daughters than it is to how the milking functions will be transmitted. The bull should be medium to large for the breed to which he belongs and full of vigor and nervous energy.

Selecting by pedigree.—The vast majority of bulls used are, and should be, selected largely upon the pedigree and records of their ancestors. Pedigree, with some attention to individuality, is the best means of selecting a bull, next to that of judging his daughters. The man who is not familiar with pedigrees, should either inform himself or get some one with this knowledge to assist him when he makes his purchase. After all there is no better way for the inexperienced than to go to a reliable, experienced breeder and rely on him to supply what the buyer needs. The prospective buyer is always justified in asking the seller for a tabulated pedigree of the bull he is considering.

In studying a pedigree, the mother of the animal in question should be given first attention. Many experienced breeders believe that dairy qualities are inherited stronger thru the sire than thru the dam. Considerable evidence has been accumulated which indicates there is some basis for this belief. At any rate the mother of the bull should by all means be as near as possible the ideal cow of the breed. Next in importance to the dam is the sire's daughters, his sisters, and especially his dam. Too much attention should not be given to ancestors back four or five generations.

It is also important to make sure the mother of the bull, even tho a good producer, is not a freak in a poor family. That is to say, if she is a splendid cow but all the rest of her family are ordinary or inferior she is not typical of her inheritance. She will probably transmit not her own excellence but the average of her family. The mother should be, if possible, one of a family all of which are high producing cows.

The sire, as stated, should be out of a high producing cow, and if she is one of a whole family of high producers, it is much more certain that these characteristics will be transmitted. If the sire has daughters in milk of course they should have a uniform high excellence. In studying records or production in pedigrees, care should be taken to make certain what the records mean. It is important to distinguish between butterfat and butter records.

It should also be understood that the per cent of fat as shown by seven-day records gives very little if any basis for estimating the average richness of the milk which the same cow will produce thruout the year. A cow owned by the University of Missouri made a seven-day record showing 5.4 per cent of fat while her average for the year was 3.3 per cent. Numerous examples could be given of similar results taken from figures published by breed associations.

The tested sire.—Whenever possible the safest way to select a bull is to choose a mature one that already has daughters in milk, so that it will be possible to judge how he transmits dairy qualities. This plan is especially valuable for the man who has a herd already well developed. It was by this means that the bull, Sultana's Virginia Lad, owned by the Unversity of Missouri, was chosen; and the average record, 9000 pounds of milk and 511 pounds of fat as two-year-olds, of his first five daughters to freshen, shows the marked success of the plan in this case. Difficulties are experienced in many cases in obtaining such a bull and as a rule only the owner of a purebred herd can afford the time and expense involved in finding such an animal.

Care and management.—The bull calf designed for breeding purposes should be fed much the same as heifer calves up to weaning time. From this time he should be kept by himself or with other bulls. He should be well fed during the entire period in order to develop to his full size. An undersized bull is never looked upon with favor. At the age of about one year a ring should be put in his nose.

A bull is old enough for light service at the age of ten months to a year. He should be used for only a few cows until at least somewhat past a year of age. The bull should never be allowed to run with the cows but kept in a strong paddock preferably where he can see the other stock. The fence should always be kept strong and in good repair. Poor fences encourage the animal to form the habit of breaking gates and fences. The bull running with the cows results in some heifers getting in calf younger than is desirable. It is also impossible under these conditions to keep an accurate breeding record which is necessary in order that the date of freshening may be known. Furthermore there is always some danger to the owner, or his family, from a bull running loose. For most herds the best shelter for the bull is a shed in his paddock, open to the south but tight on other sides to keep out cold winds and storms. A certain amount of open air treatment is beneficial to the animal altho a bull so treated does not make so good an appearance on account of the long hair developed during the cold weather. The most common mistakes made in handling bulls are allowing them to run with the cows when young and unnecessarily exhausting themselves, then shutting them up in a stall or small pen without sufficient exercise when they become mature. A bull not allowed to run with the herd when young and sufficiently exercised when mature will generally retain his breeding qualities until ten or twelve years old.

The bull should receive sufficient feed to keep him in moderate flesh after maturity. The ration fed may be quite similar, except in amount needed, to that given the cows in the herd.

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A. J. Meyer, Director

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Canning by the One-Period Cold Pack Method

Addie D. Root

Before beginning to can read pages 4 to 9 and follow directions carefully.

Household canning may be done by the open kettle method or the cold pack method. In the former, the material to be canned is completely cooked before it is put into the jar. In the latter, or cold pack method, the cooking and sterilizing are mainly done after the material has been packed in the jar.

The advantages of the cold pack method over the open kettle method are: (1) It is adapted to all fruits and vegetables; (2) it is more certain; (3) it saves time and labor; and (4) it produces a more uniform product with a better color, better flavor, and better shape.

WHY FRUITS AND VEGETABLES SPOIL

There are present everywhere very tiny plants known as bacteria, yeasts, and molds which are called micro-organisms because they can be seen only with a microscope. These small organisms cause the spoilage of food. If, in the process of canning, they are killed by heat, and if the jar is sealed so tightly that no more can enter, food will keep indefinitely. In the cold pack method of canning the partially sealed jar with its contents is heated to a high enough temperature for a sufficient time to kill all of the micro-organisms present. Then the jar is sealed tightly. Killing such organisms by heat is called sterilization.

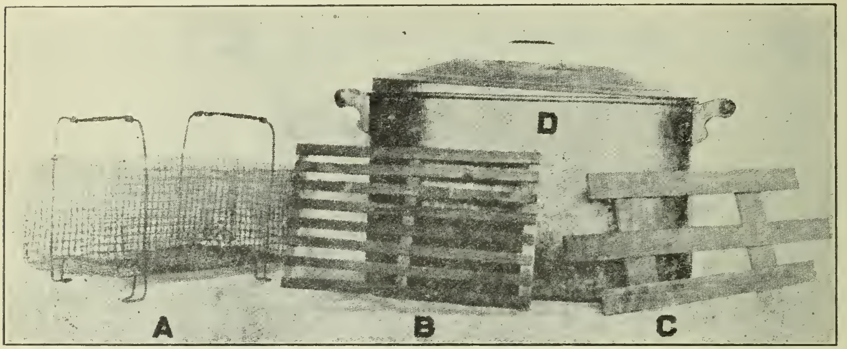

Fig. 1.—Water-bath outfit. A, Wire rack. B and C, Wooden racks. D, Wash boiler.

TYPES OF CANNERS WHICH MAY BE USED

Water-bath outfit.—The simplest type of canner is the water-bath outfit. This consists of any vessel such as a wash boiler, tin pail or lard can which: (1) is deep enough to allow the jars to be covered with water (2) has a flat bottom (3) has a well fitting lid. A rack made of wire, tin or narrow strips of wood is necessary to keep the jars from touching the bottom of the container. It should raise the jars at least three-fourths of an inch and allow the water to circulate freely beneath. Handles placed upon the ends of the rack aid in lifting the jars in and out of the hot water. Hay, straw, paper, towels, or loose boards should not be used in place of racks. Individual jar holders which are very desirable may be bought at a reasonable cost.

Steam pressure outfit.—A second type of home canner is the steam pressure outfit. Under pressure the temperature of water may be raised several degrees above the boiling point. This higher temperature destroys micro-organisms more quickly than the boiling temperature. The steam pressure outfit is, therefore, a saver of time and fuel, but the initial cost is greater than that of the water-bath outfit.

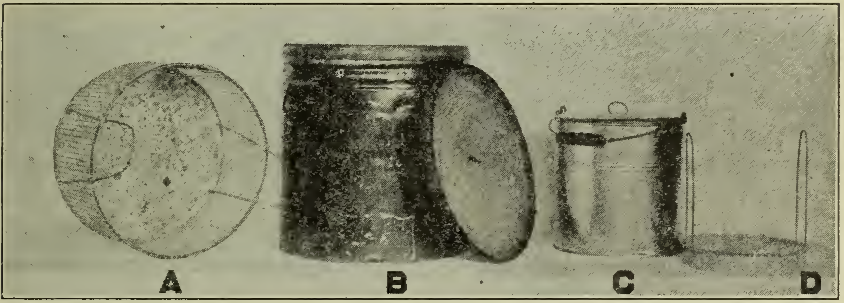

Fig. 2.—Types of water-bath outfits. A and D, Wire racks. B, Lard can. C, Tin pail.

JARS AND TOPS

All of the three representative types of jars shown in Figure 4 are satisfactory. Jars should be of good quality glass, smooth and well finished. More important than the jar itself is the method by which it is sealed. The top is, therefore, the important consideration.

Screw tops.—Screw tops should never be used the second year if they are defective, discolored or corroded. To test the screw tops, adjust them on the jars without the rubber, screw down until tight and run the thumb nail or a knife blade around between the top and the glass. If this can be done easily, either the top or the jar is defective. An old top which has been removed from the jar by prying up with a knife, usually has a bent edge and should be discarded. Jar tops may be removed without injury by inverting the jar a few moments in hot water or by pulling the rubber out from under the top.

Glass tops.—When using jars with glass tops and metal clasps, be certain that the springs and clasps are tight and strong. The wire bail placed over the top of the cover should go in the groove with a snap, even when the tightening lever or clamp spring is up. If it does not, remove bail from tightening lever and bend to make tight. A good test for glass and screw top jars is to put water in the jar, adjust rubber and lid, invert and shake. If the jar leaks, tighten the bail or use another lid.

Lacquered tops.—Examine jars with lacquered tops such as that shown in Figure 4 to see if the composition in the groove of the top is cracked. If it is, do not use the top. The composition deteriorates with age so that for this type of jar new tops are necessary each year. A top that is carried over from the season before cannot be used. If this type of jar does not seal when heated, remove, scrape the composition off the jar and use a new top.

RUBBER RINGS

It is very important that new, good, rubber rings be selected. Test for elasticity by pulling. They should not break easily and should return to shape. When doubled between the fingers, the rubber should not crack or even show little holes. When placed on the jar it should fit closely. Do not select rings by color but by test. Do not use the same rubber twice. It is cheaper to buy new rubbers than to lose a jar of fruits or vegetables.

GENERAL CANNING DIRECTIONS

The method of canning is practically the same for all fruits and vegetables. There are, however, slight but important variations which make necessary the specific directions in the following pages.

STEPS IN CANNING

1. Select only fresh fruits and vegetables. Do not attempt to can over-ripe fruit or over-mature vegetables.
2. Clean and prepare the product.
3. Scald or blanch as directed. Only enough of the product should be blanched at one time to fill a few jars.
4. Cold dip immediately.
5. Pack product at once in the jar and adjust rubber.
6. Add a teaspoonful of salt for each quart of vegetables.
7. Fill jar with hot water or syrup.
8. Adjust top, but leave it slightly loose.
9. Sterilize the required time.
10. Remove from canner and finish sealing. Do not remove top or rubber after sterilization. Place jars out of draft to cool.

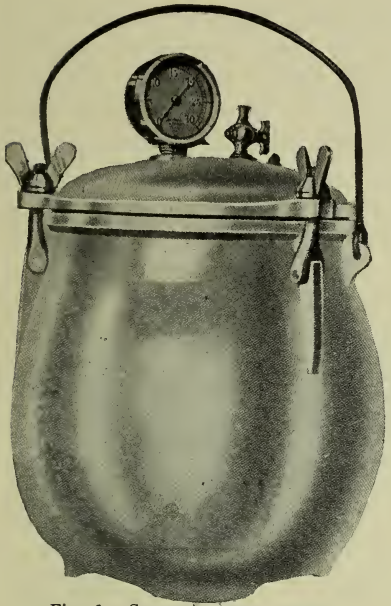

Fig. 3.—Steam pressure canner.

Selection of product.—Select varieties of fruits and vegetables suitable for canning. Can all fruits and vegetables as soon as possible after they are gathered, within two hours after picking is preferred. Special care should be taken in canning peas, beans, corn and asparagus, as they are likely to acquire a disagreeable flavor known as "flat sour" if they are not canned soon after picking or if they are allowed to stand between blanching and packing. This type of spoilage may not cause the product to look fermented but the vegetables will have a disagreeable smell and taste.

Scalding.—*Scalding,* as used in canning, applies to the dipping of fruits and vegetables in boiling water.

Blanching.—*Blanching* consists in immersing the product in boiling water and leaving it in the water for a definite time after the water has again begun to boil. (The term *boiling water* applies to that stage when the large bubbles break on the entire surface of the water and the water is jumping.) When vegetables or fruits are put into boiling water, they lower the temperature so that the water does not boil again for a few minutes. Do not begin to count the time for blanching until the water is really boiling. A yard square of cheese cloth, a flour sack or a wire basket may be used to hold the product while blanching and cold dipping. In the case of greens and green vegetables, this process may be accomplished in a satisfactory manner by steaming them over boiling water.

Cold dipping.—As soon as the product is removed from the boiling water or steam, it should be plunged into clean, cold water, and removed immediately. Do not let products stand in the cold dip, as the water becomes luke warm and softens them. Do not allow products to stand long after blanching and cold dipping. Pack the jar and place in canner immediately.

Scalding or blanching, and cold dipping are advised in the case of fruits and vegetables except the soft fruits because the process:

(a) loosens skins of fruits and vegetables; (b) shrinks the products, and thus permits more to be packed in the jar; (c) aids in preserving the color and shape; (d) shortens the period of sterilization.

Packing.—Pack products carefully in clean, hot, tested jars. Soft fruits or vegetables should be packed as close as possible without crushing. A closer pack may be obtained if the jar is shaken occasionally while packing. Shelled beans, peas and corn swell when sterilized so that they should not be packed closely and should be packed only to within one inch of the top of the jar.

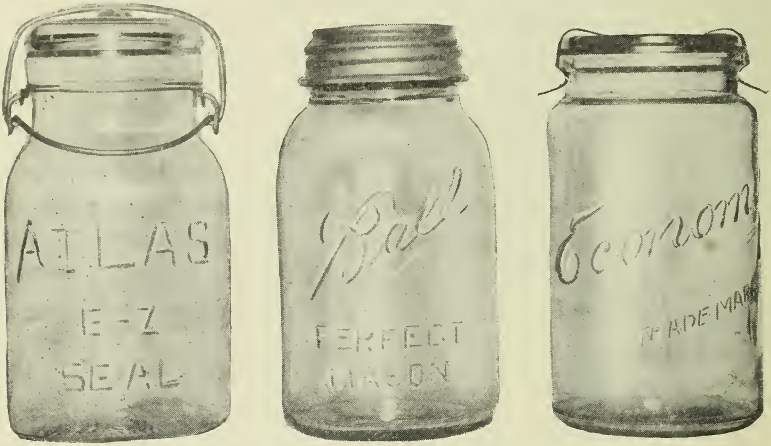

Fig. 4.—Types of jars.

Filling.—Add one teaspoonful of salt to each quart of vegetables. Add sufficient boiling water to vegetables and enough syrup to fruits, to cover the products in the jar. Fruit may be canned without syrup and the jars may be filled with water or fruit juice. A small funnel thru which to pour the hot liquid will help in preventing breakage of jars. Wipe off the top of the jar before adjusting rubber and lid.

Syrup for canned fruit.—It is not necessary to use syrup in canned fruits. However, sweetened fruits are usually preferred. There is no set rule for making syrup. The amount of sugar required will depend upon the individual taste. The ideal syrup should contain enough sugar to improve but not to destroy the natural flavor of the fruit. Too thick a syrup destroys the desirability of the canned products as a substitute for fresh fruit in the diet.

Adjusting tops.—When using a screw-top jar, such as that shown in Figure 4, place the top in position and screw down tight.

Then make a slight turn back to loosen. If glass tops fastened with wire bails are used, the bail is put in place, but not clamped until after sterilization. If a jar with lacquered top is used, place the wire clamp in position. This holds the top in place until it is sealed in the process of sterilization.

TIME TABLE FOR BLANCHING, SCALDING, AND STERILIZING VEGETABLES, FRUITS AND MEATS

Products	**Blanch** or scald—Min.	Time of Sterilization[1]		
		Water-Bath[2]	Steam Pressure 5 pounds	Steam Pressure 10 pounds
VEGETABLES				
Asparagus	15	2 hrs.	1 hr.	40 min.
Beans (String)....	5-10	2 hrs.	1 hr.	40 min.
Beans (Lima)	5-10	3 hrs.	1 hr.	40 min.
Beets	5 -	1½ hrs.	1 hr.	40 min.
Carrots	5	1½ hrs.	1 hr.	40 min.
Cauliflower	3	1 hr.	½ hr.	20 min.
Corn	8-15	3½ hrs.	1½ hr.	1 hr.
Corn on cob......	8-15	4 hrs.	1½ hr.	1 hr.
Egg plant.........	8-10	2 hrs.	1 hr.	40 min.
Greens	14	2 hrs.	1 hr.	40 min.
Okra	5-10	2 hrs.	1 hr.	40 min.
Parsnips	5	1½ hrs.	1 hr.	40 min.
Peas	5-10	3 hrs.	1 hr.	40 min.
Peppers	5-10	1½ hrs.	1 hr.	40 min.
Pumpkin	3	2 hrs.	1 hr.	40 min.
Squash	3	2 hrs.	1 hr.	40 min.
Sweet Potato	5	1½ hrs.	1 hr.	40 min.
Tomatoes	1½	22 min.	15 min.	10 min.
FRUITS[3]				
Apples		20 min.	12 min.	8 min.
Apricots		16 min.	10 min.	5 min.
Berries		16 min.	10 min.	5 min.
Cherries		16 min.	10 min.	5 min.
Grapes		16 min.	10 min.	5 min.
Peaches		16 min.	10 min.	5 min.
Pears		30 min.	12 min.	8 min.
Plums		16 min.	10 min.	5 min.
Quinces		20 min.	12 min.	8 min.
Rhubarb		16 min.	10 min.	5 min.

(See page 8 for footnotes to references)

TIME TABLE FOR BLANCHING, SCALDING, AND STERILIZING VEGETABLES, FRUITS AND MEATS—Continued.

Products	Blanch or scald—Min.	Time of Sterilization[1]		
		Water-Bath[2]	Steam Pressure 5 pounds	Steam Pressure 10 pounds
MEATS				
Beef		3½ hrs.	2½ hrs.	1 hr.
Fish		3½ hrs.	2½ hrs.	1 hr.
Lamb		3½ hrs.	2½ hrs.	1 hr.
Opossum		3½ hrs.	2½ hrs.	1 hr.
Pork		3½ hrs.	2½ hrs.	1 hr.
Poultry				
Method 1		3½ hrs.	2½ hrs.	1 hr.
Method 2		4 hrs.	3 hrs.	1 hr.
Method 3		3½ hrs.	2½ hrs.	1 hr.
Raccoon		3½ hrs.	2½ hrs.	1 hr.
Rabbit		3½ hrs.	2½ hrs.	1 hr.
Sausage		3½ hrs.	2½ hrs.	1 hr.
Squirrel		3½ hrs.	2½ hrs.	1 hr.

[1] The time given in the directions thruout this publication is for quart jars. Add ten per cent for half-gallon jars and deduct ten per cent for pint jars.

[2] In canning with the water-bath outfit, time should be counted only while the water is *boiling hard*—when large bubbles are breaking on the entire surface of the water and when the water is jumping. If the water, for any reason, should stop boiling during the sterilization process, time should not be counted until boiling is resumed.

[3] Apples, apricots, peaches, pears, plums, and quinces may be blanched if desired. The average time required is from one to two minutes, depending on the firmness of the fruit.

Sterilizing.—The water in the canner must cover the tops of the jars at least one inch. This insures more perfect sterilization and helps to prevent the liquid from boiling out of the jars. If the water in the canner boils down during the sterilization period, boiling water may be added. If the water in the canner stops boiling, cease counting time until it boils again. In the steam pressure canner, water should come as high as the platform but no higher.

Time of sterilization.—The time given in the directions is for quart jars. Add ten per cent for half-gallon jars and deduct ten per cent for pint jars. In all cases the water must be boiling during the entire time given for sterilization. In the water-bath, count time only while the water is boiling.[1] In the steam pressure canner, the pressure (see time table page 7) must be forced to the required point before counting time and maintained during the entire period of sterilization.

Cooling.—When jars are removed from canner, tighten covers, test for leaks, and cool. Do not let jars cool in a draft for it may cause them to break.

Storing.—Wrap jars with paper to prevent products from bleaching or fading and store them in a dry place.

CANNING FRUITS

Apples.—Select firm, ripe apples. Remove all blemishes and can the fruit whole, sliced or quartered. Remove the cores if it is to be canned whole. Keep apples from turning brown by putting them, as soon as cut, into water containing one tablespoonful of salt to a gallon. Pack the apples into jars as tightly as possible without crushing. Make a syrup of four cups of water and one to two cups of sugar, depending upon the sourness of the fruit. When the sugar is completely dissolved and the syrup begins to boil, fill the jars with the syrup. Adjust the tops and partially tighten. Sterilize whole apples twenty minutes; sliced and quartered, twelve mintes in water-bath canner. See time table page 7 for steam pressure time. Remove jars and tighten covers.

Apricots.—Select apricots of uniform ripeness. Scald, and plunge into cold water. The skins will then be easily removed. The fruit may be canned with the skin on if preferred. If the pits are left in an added flavor is given to the fruit. Pack the fruit into jars. Make a syrup of one cup of sugar and three cups of water. When the sugar is dissolved and the syrup begins to boil, fill jars with the syrup. Adjust tops and partially tighten. Sterilize in water-bath canner sixteen minutes. See time table page 7 for steam pressure time. Remove jars and tighten covers.

Berries.—Pick over, wash and stem the berries. Use a colander or sieve in washing them to prevent handling or bruising. Fill the jars with the berries, pack them as tightly as possible without crushing. A jar will hold more berries if the berries are shaken down. Make a syrup according to the proportions given in the following paragraph. When the sugar is completely dissolved and the syrup begins to boil, fill the jars with the syrup. Adjust the tops and partially tighten. Sterilize in water-bath canner for sixteen minutes. See time table, page 7, for steam pressure time. Remove the jars and tighten tops.

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[1] The term *boiling water* applies to that stage when large bubbles break on the entire surface of the water and the water is jumping.

Proportions for syrup.—(1) To make syrup for blackberries, dewberries, loganberries, mulberries, and raspberries use one cup of sugar to four cups of water.

(2) For strawberries, cranberries, currants, and gooseberries use one cup of sugar to one cup of water.

Cherries.—Wash and remove the stems of cherries and can with or without the stones. If they are stoned, all the juice should be carefully saved. Fill jars with cherries and pack as tightly as possible without crushing. For sour cherries, make a syrup of one cup of sugar and two cups of cherry juice. For sweet cherries, make a syrup of one cup of sugar and three cups of cherry juice. If there is not enough juice to complete the measure, add water. When the sugar is completely dissolved and the syrup begins to boil, fill the jars with the syrup. Adjust the tops and partially tighten. Sterilize in the water-bath canner sixteen minutes. See time table page 7 for steam pressure time. Remove jars and tighten tops.

Grapes.—Follow directions given for canning blackberries.

Peaches.—Follow directions given for canning apricots.

Pears.—Follow directions given for canning apples, but sterilize thirty minutes.

Plums.—Follow directions given for canning apricots.

Quinces.—Follow directions given for apples.

Rhubarb.—Wash and cut rhubarb into lengths to fit the jar or into pieces of uniform size. Blanch for one minute, then plunge into cold water. Fill the jars with rhubarb, packing as tightly as possible. Make a syrup of one cup of sugar and one cup of water. When the sugar is completely dissolved and the syrup begins to boil, fill the jars with syrup. Adjust the tops and partially tighten. Sterilize in water-bath canner for fifteen minutes. See time table, page 7 for steam pressure time. Remove jars and tighten tops.

CANNING VEGETABLES

Asparagus.—Select asparagus stalks of uniform age, size and color. Prepare by washing well with a vegetable brush. Cut off the woody part of stalks. Cut the stalks into long or short pieces of uniform length. Blanch from three to five minutes, according to the age of the vegetable, and then plunge quickly into cold water. The asparagus may be tied into bunches for blanching. Place the bunches, tips up, in water for half of time given for blanching then turn on side. The tops will then retain their shape. Fill the jars with asparagus, by packing as closely as possible—with the tips up if whole stalks are used. Add a teaspoonful of salt to each quart and fill the jar with boiling water. Adjust the tops and partially tighten. Sterilize in water-bath canner for two hours. See time table page 7 for steam pressure time. Remove jars and tighten tops.

Beans (lima and string).—Select beans of the same age and color. Wash thoroly and string or shell. String beans may be canned whole or cut into uniform pieces. Blanch by placing into boiling water from five to eight minutes, depending upon age, and plunge quickly into cold water. Fill the jars, by packing as closely as possible. Add one teaspoonful of salt to each quart. Fill the jars with boiling water. Adjust the tops and partially tighten. Sterilize lima beans in water-bath canner three hours, and string beans two hours. See time table page 7 for steam pressure time. Remove jars and tighten tops.

Beets.—Select beets of uniform size and age. The older the beets the more chance there is for loss of color. Small beets are the most desirable for canning. Prepare by washing thoroly with a vegetable brush. Leave one inch of the top and all of the root on while blanching as this will aid in preventing the loss of color. Blanch six minutes, then plunge quickly into cold water. Remove the skins by scraping, not peeling, the beets. Skin may be left on if desired and removed when taken from the can. Pack beets into the jars as closely as possible. Add a teaspoonful of salt to each quart and fill the jar with boiling water. Adjust the tops and partially tighten. Sterilize in water-bath canner for one and one-half hours. See time table page 7 for steam pressure time. Remove jars and tighten tops.

Carrots.—Wash carrots thoroly with a vegetable brush. Blanch from six to eighteen minutes, depending upon the age, then plunge quickly into cold water. Scrape. Fill the jars. Add one teaspoonful of salt for each quart. Fill the jars with boiling water. Adjust the tops and partially tighten. Sterilize in water-bath canner for one and one-half hours. See time table page 7 for steam pressure time. Remove jars and tighten tops.

Cauliflower.—Place the flowered portions of the cauliflower in a cold brine made in the proportion of one-half cup of salt to one quart of water. Allow the cauliflower to remain in this brine for one hour. Blanch it three minutes and plunge quickly into cold water. Pack in hot jars. Add one teaspoonful of salt to each quart and fill the jars with boiling water. Adjust tops and partially tighten. Sterilize in water-bath canner for sixty minutes. See time table page 7 for steam pressure time. Remove jars and tighten tops.

Corn.—Select ears of the same variety and degree of ripeness. Prepare by removing the husks and silks. Blanch from eight to fifteen minutes, depending upon the ripeness of the corn, then plunge quickly into cold water. If the corn is canned on the cob, fill the jars with ears, alternating the tips and butts. If the corn is to be cut from the cob, after blanching, use a thin, sharp knife. Fill the jars loosely, leaving a space of one inch from the tops for expansion. Add a teaspoonful of salt to each quart and fill the jars with boiling water. Adjust tops and partially tighten. Sterilize in water-bath canner for three hours and a half if cut from the cob or four hours if on the cob. See time table page 7 for steam pressure time. Remove jars and tighten tops.

Eggplant.—Pare the eggplant or leave the skin on, cut into slices and blanch eight to ten minutes. Then plunge quickly into cold water. Pack the slices in the jars as closely as possible. Do not add salt as it causes eggplant to turn dark. Fill the jars with boiling water. Adjust tops and partially tighten. Sterilize in water-bath canner two hours. See time table page 7 for steam pressure time. Remove the jars and tighten tops.

Greens.—Greens should be picked over carefully and washed in cold water until all traces of sand are removed. Blanch in vessel with a little water under false bottom or in a regular steamer fifteen to twenty minutes or until thoroly shrunk. Pack greens into jars as tightly as possible. Add one teaspoonful of salt to each quart. Fill the jars with boiling water. Adjust tops and partially tighten. Sterilize in water-bath canner two hours. See time table page 7 for steam pressure time. Remove jars and tighten tops.

Okra.—Follow directions given for beans.

Parsnips.—Follow directions given for carrots.

Peas.—Follow directions given for beans. Sterilize three hours.

Pepper (green and red).—*Method 1.* Wash, cut a slice from stem end of each pepper and remove seed. Blanch three minutes and plunge into cold water. Fill the jars with whole or sliced peppers, pack as closely as possible. Add one teaspoonful of salt to each quart and fill the jars with boiling water. Adjust tops and partially tighten. Sterilize in water-bath canner two hours. See time table page 7 for steam pressure time. Remove jars and tighten tops.

Method 2. Place the peppers in the oven and bake them until the skins separate from the meat. Remove the skins. Pack in hot jars that have been heated in hot water. Add one teaspoonful of salt to each quart. Fill the jars with boiling water. Adjust tops and partially tighten. Sterilize as given in Method 1.

Pumpkin or squash.—*Method 1.* (For special dishes, fried, creamed and baked). Remove seed, pare and cut into small blocks of uniform size. Blanch ten minutes. Plunge quickly into cold water. Pack as closely as possible into jars. Add one teaspoonful of salt to each quart of vegetable and fill the jars with boiling water. Adjust tops and partially tighten. Sterilize in water-bath canner two hours. See time table page 7 for steam pressure time. Remove jars and tighten tops.

Method 2. (For pie filling) Cut into convenient sections. Core and remove skin. Cook thirty minutes to reduce to a pulp. Pack in jars. Add one teaspoonful of salt to each quart of pulp. Adjust tops and partially tighten. Sterilize as given in Method 1.

Sweet potatoes.—Follow directions given for carrots.

Tomatoes.—Select tomatoes of the same size, ripeness and color. Scald to loosen skins. Plunge quickly into cold water. Remove the stems and skins and cut tomatoes into pieces if desired. Fill the jars with the whole or cut tomatoes and pack as tightly as possible without crushing. Add one teaspoonful of salt to each quart. Since such a large part of the tomato is water it is not necessary to add liquid. However, the jars may be filled with strained tomato juice or cooked tomato if desired. Adjust tops and partially tighten. Sterilize in water-bath canner twenty-two minutes. See time table page 7 for steam pressure time. Remove jars and tighten tops.

CANNING MEAT[1]

Poultry and game birds.—*Method 1.* Kill fowl and draw at once. Wash and cool. Cut into sections and place in kettle. Cover with hot water and boil until meat can be removed from bones. After meat has been removed from the bones, pack closely into glass jars. Add one teaspoonful of salt to each quart and fill jars with the pot liquid. Adjust tops and partially tighten. Sterilize in water-bath canner three and one-half hours. See time table page 8 for steam pressure time. Remove jars and tighten tops.

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[1] Adapted from United States Government Bulletins.

Method 2. Kill fowl, draw at once and cut into pieces. Pack in jars. Add one teaspoonful of salt to each quart and fill the jars with boiling water. Adjust tops and partially tighten. Sterilize in water-bath canner four hours. See time table page 8 for steam pressure time. Remove jars and tighten tops.

Method 3. (Spring chicken, fried) After cleaning, season and fry as when preparing for serving, but without the use of flour. Cook until three-fourths done. Pack in jars. Pour liquid from the frying pan over the chicken. Place tops in position and partially tighten. Sterilize in water-bath canner three and one-half hours. See time table page 8 for steam pressure time. Remove jars and tighten tops.

METHOD FOR PACKING CHICKEN

Use one-quart jar. Do not pack the giblets with the meat.

1. Have the jar hot.
2. Pack the saddle with a thigh inside.
3. Pack the breastbone with a thigh inside.
4. Pack the backbone and ribs with a leg inside.
5. Pack the leg, large end downward, alongside the breastbone.
6. Pack the wings.
7. Pack the wishbone.
8. Pack the neck bone.

Beef, pork, sausage rabbit, squirrel, raccoon, opossum, lamb and fish.—Prepare by frying, oven baking, roasting or stewing. Do not roll meat or fish in flour as the flour prevents the heat from penetrating the flesh to some extent and makes the meats hard to sterilize. Cook three-fourths done. Pack in jars and add the gravy from the roasting pan or the pot liquid. Adjust tops and partially tighten. Sterilize in water-bath canner three and one-half hours. See time table page 8 for steam pressure time. Remove jars and tighten tops.

CONTENTS

Page
Why Fruits and Vegetables Spoil 2
Types of Canners 2
Jars and Tops 3
Rubber Rings 4
General Canning Directions 4
Time Table for Canning Vegetables 7
Time Table for Canning Fruits 7
Time Table for Canning Meats 8
Directions for Canning Fruits 9
Directions for Canning Vegetables 10
Directions for Canning Meat 13
Method for Packing Chicken 14

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UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

AGRICULTURAL EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 53 COLUMBIA, MISSOURI AUGUST, 1918

Storing Vegetables

J. T. Rosa, Jr.

The general principles of vegetable storage applicable to practically every crop which is likely to be stored are as follows: First, store only vegetables in good condition, matured but not stale, free from disease and bruises, and which have not been exposed to heating or wilting. Second, store vegetables before they have been severely frosted. The storage conditions must be right. The storage temperature should be steady, and for most vegetables it should remain below 50 degrees Fahrenheit. From 36 to 40 degrees F. gives best results with most vegetables, especially with the root crops (except sweet potatoes). Ventilation must be provided, yet the atmosphere of the storage place should be kept rather moist to prevent the vegetables from shriveling or wilting.

TYPES OF STORAGE

The general types of storage arrangements which are in use for vegetables and which are practical under most conditions are herein described, but it should be remembered that local conditions or other factors may cause or permit many modifications of these systems.

The house cellar.—The cellar or basement is generally available for storage purposes, but the furnace or heater often makes it too warm for most vegetables, except for temporary storage. The rather warm, dry cellar does provide ideal storage conditions for sweet potatoes, squash and pumpkins. Certain root crops also can be stored here by bedding the roots in boxes or barrels of slightly moist sand to prevent drying and shriveling.

For storage of most vegetables in the house cellar, the proper conditions can be obtained by walling off a corner of the cellar farthest from the heating system to serve as a cold room. This may also be a convenient place to keep canned goods, preserves, and kraut. Meat and dairy products may also be kept in such a room temporarily, altho there is danger of tainting the flavor of the vegetables. The cold room should have a hard dirt or a concrete floor; and if in a damp locality, there should be a tile drain in the center, toward which the floor should slope. If this drain enters a sewer, there should be a bell trap at the mouth to prevent entrance of impure odors and gases into the cellar from the sewer. This trap will also prevent draining out the cool air of the cellar on warm days. If any heating pipes pass thru this room, they should be covered with asbestos to prevent undue heating of the storage room. This room should have one or more openings to the outside which can be regulated to control the temperature as well as to provide ventilation. During the early part of the storage period when the vegetables are fresh and green and when outside temperatures are rather high, ventilation is needed most. The storage room is cooled by opening the ventilator at night to let in the cool air and closed early in the morning to prevent the influx of warm air. This method is more effective if the room is on the north side of the house or in a heavily shaded position. The walls which separate the storeroom from the rest of the cellar should be tight and may be built either of hollow tile, masonry, concrete or a double wooden wall with a four-inch air space between the walls and a layer of building paper on the inside to complete the insulation. There should be only one door, which should fit tightly and be large enough to admit barrels and large boxes. A chute opening to the outside may be convenient in placing articles in storage, but it should have a tight door.

The storeroom should be kept dark most of the time but it should be arranged so that plenty of light may be had when desired. Along one side of the room should be bins in which to store potatoes and root crops in bulk. The bins should have a false slat floor four inches above the floor of the room, and it is also desirable to have a false back consisting of slats one inch apart and four inches from the solid wall. This construction permits free circulation of air, insuring the aeration of stored products in all parts of the storeroom. The bin may be partitioned into compartments with fixed or movable walls, so that medium quantities of different vegetables can be stored without mixing. The bins should be covered with four-inch strips nailed two inches apart, thus forming a broad shelf which is very convenient for storing boxes and other articles. On the other side of the room there should be a series of shelves one above the other, three feet wide and fifteen to eighteen inches apart. These are useful to hold boxes or to stack up canned goods and preserves, as well as to store various vegetables in small bulk, as cabbage, tomatoes and fruit. The space in the middle of the room can be used to place barrels and boxes which contain stored products.

Caves or outside cellars.—This is probably the most popular style of storage for vegetables and fruits in Missouri. These structures are simple and cheap and the size is regulated by the need for storage space. For storing small quantities, perhaps the cold room in the cellar is more convenient, at least for town gardeners. Because various root crops are commonly stored in this type of cellar, they are often referred to as "root cellars," altho many other crops can be stored in them successfully. The best type of outdoor cellar is two-thirds or more below the surface of the ground, with steps leading down to an inner door. Where there is a hillside near the kitchen door, conditions are ideal for the construction of such a cellar, with the entrance nearly on the level, and the body of the cellar in the hillside. Outdoor cellars of this type should be covered with earth and sod from one to three feet deep over the whole exterior, except the space for the door. This provides insulation and makes it easy to maintain constant temperatures in the cellar.

Outdoor cellars may be built of wood or concrete. The first step is to prepare the excavation for a cellar of the desired size. The excavated earth is used to cover the cellar when completed. The floor may be hard-packed dirt or concrete; but the dirt floor is generally best, because it supplies some moisture to the atmosphere in the cellar. A six-inch tile placed in the center of the floor should connect with the open some distance away and thus serve as a drain and ventilator. In constructing a wooden cellar, a row of rough posts about five feet high is set along each side of the pit and topped with a 4 by 6 inch plate, which serves as a support for the rafters. The walls may consist of poles or plank nailed along the outside of the row of posts, and the roof may be of the same material. Earth and sod are banked heavily on the sides and roof, to make the cellar rain and frost-proof. The exterior of the cellar mound should be rounded so that water will run off readily. A four or six inch tile which will serve as a ventilator should be inserted thru the roof of the cellar at the end farthest away from the door. This ventilator may have a hood to keep out the rain and should always be closed in cold weather. A convenient size of cellar of this type for farm storage is 10 by 18 feet. Such a cellar will easily contain 400 bushels of vegetables. A smaller size can be constructed for storing vegetables strictly for home uses. The door and the steps leading down to the cellar should be enclosed in a frame vestibule, which may also be used as a temporary storage place, or implement room.

Concrete is preferable for the outdoor cellar as it provides a permanent structure, and storage conditions are as good or better than in the wooden cellars. The excavation should be made the exact size of the proposed cellar so that the earth can serve as the outer wall of the form. The walls should be at least five inches thick. The roof should be in the form of a flat arch, with one-half inch iron rods inserted every foot for reinforcement. The form for the roof is made by sawing out arches of the desired curve and supporting these within the cellar on temporary studdings of the same height as the side walls. Boards laid lengthwise on the arches complete the forms on which the concrete for the roof is poured. The reinforcement rods should be inserted near the lower surface of the concrete layer to give the greatest strength to the roof. A flat roof is easier to construct and is satisfactory for the smaller cellars, if well reinforced. The ventilation and insulation of the concrete cellar should be arranged in the same way as for the wooden structures. The cellar should have bins along one or both sides to contain the stored products in bulk, with a shelf above for storing boxes and smaller articles. The bins should have false floors and backs, with the same type of slat construction as suggested for the house cellar to provide free circulation of air. Vegetables can usually be kept later in the spring in these cellars than in any other type of natural storage.

Outdoor pits or banks.—This simple method of storage provides a very cheap and efficient way to keep potatoes, cabbage and root crops; but generally it is a rather inconvenient and laborious method as compared with a permanent cellar.

This method, however, is very useful when other facilities do not exist. A well-drained spot should be selected for the storage pit, and it is preferable to have it shaded by trees or buildings. The surface soil is generally removed to a depth of about one foot. A conical pile of about fifteen bushels of vegetables is a convenient bulk to store in each pit. A greater bulk can be stored in the same pit by extending it longitudinally, thus forming a long low bank instead of the conical heap. The vegetables should not be piled deeper than four feet and six or seven feet wide at the base. A trucker who has a large quantity of several kinds of vegetables to store should prepare separate pits for each kind. For the home-gardener, who generally has small quantities of different vegetables to store, a single pit of some size is more satisfactory than a number of very small pits. For convenience in obtaining small quantities of each of the vegetables for immediate use during the winter, the pile should be arranged in elongated form, with the different vegetables in layers which extend the length of the pit. A supply of each kind can be obtained then by opening only one end of the pit. Potatoes and cabbage may be placed in the pit in direct contact with the soil, but for other vegetables it is better to line the pit with three or four inches of straw. On this the vegetables to be stored are piled to a depth of three or four feet, thereby forming an inverted V-shaped bank. They should be covered at once with a layer of straw, leaves or cornstalks to a depth of six inches, which will be all the protection needed until cold weather. Then a layer of earth from six to ten inches deep should be placed over the whole pile, and the ridge rounded off to shed the rain. To provide ventilation, the inner straw layer is often allowed to protrude a few inches at the peak of the ridge. This should be sheltered from the weather by an inverted trough made of two boards nailed together at right angles. For further protection another layer of straw may be placed above the layer of earth after a hard freeze in the early winter. This will protect the bank from constant freezing and thawing during the winter, which would be injurious to the vegetables. Large banks which are not opened until late winter or spring should be ventilated by some means. This may be accomplished by the ridge arrangement already described, or a rough flue made by placing three or four stakes in the center of the pile and extending them to the exterior. This flue admits fresh air and also carries off some of the moisture and gases given off by the stored vegetables. The flue, however, must be closed in very cold weather. It is not advisable to open pits when the temperature is far below freezing; and when a pit is opened, the hole should be closed securely.

Trenches.—To store parsnips, salsify, rutabagas and other root crops which are not injured by freezing, an outdoor trench is satisfactory. This must be on a well drained spot and should be three feet deep, three or four feet wide, and as long as desired. The roots are placed in the trench in direct contact with the earth at a somewhat later date than when placed in outdoor banks. The roots are piled about flush with the ground line and covered with a six-inch layer of earth and a heavy mulch of straw or manure on the surface, which completes the insulation. Celery and cabbage are stored nicely in shallower trenches of this style, but generally must be used by mid-winter. The root crops can be kept to the middle of the spring if the outdoor trenches are in a shaded spot.

Hotbeds and cold-frames.—The empty hotbed and cold-frame may be used to good advantage during the fall and winter for storing vegetables. The soil and spent manure should be removed from the hotbed and used on the garden during the summer. The empty pit is then available for storing in bulk potatoes and root crops of all kinds. Celery and cabbage also can be stored here by pulling the plants with the roots on and setting them closely together in the upright position, with the roots embedded in a few inches of loose moist soil in the bottom of the pit. The cold-frame is used in the same way as the hotbed; but since it has no pit, its capacity is limited. The regular glass sash can be used to cover these structures when used for vegetable storage, but they must be supplemented with board shutters, straw mats, or loose straw to protect the contents from sunlight and from freezing and thawing. The walls on the outside should be well banked with soil or manure.

Special storage houses.—For extensive storage of various crops in commercial quantities, such as sweet potatoes, Irish potatoes, onions, and cabbage, special types of large storage structures are required. These may be partly below ground or built on the level. They should have double or frost-proof walls, which may be lined with felt or building paper. In case of sweet potatoes, a heating system with special ventilators is necessary.

METHODS OF STORING VARIOUS VEGETABLES

Irish potatoes.—This crop should be left in the ground until the middle of the fall, then dug and placed in storage. The tubers should be carefully handled, as bruises or cuts are generally the starting points of decay. Any of the methods of storage described in this circular will serve for potatoes, but the outdoor pit probably is the method most used in Missouri. Potatoes which have frozen in the ground should not be placed in storage, and potatoes should not be exposed to actual freezing in their storage place. If moist when placed in storage, and no chance is given for aeration, potatoes may heat badly just after going into storage. If the storage temperature ranges above 45 degrees F., the eyes will sprout before spring. This is undesirable and can be prevented largely by keeping the potatoes dry and as cool as possible toward spring. Potatoes will keep well stored in bulk, or they may be stored in boxes or barrels.

Root crops.—Many vegetables, such as parsnips, salsify, horseradish, rutabagas, winter radishes and celeriac are included under this general term and require the same general treatment. They should be kept cool and somewhat moist. They are not injured by freezing and are usually left in the ground until after the first freeze in autumn. Another group of vegetables handled in the same general way as the foregoing, but which are more tender to cold, are beets, carrots, kohlrabi, leeks, and turnips. The first two mentioned are subject to excessive wilting or shriveling in storage unless they are kept moist. This is often done in the house cellar by burying the roots in barrels of moist sand which will keep them in plump condition until spring. This group should be harvested before heavy freezing. To have all the foregoing crops tender and in the best of condition for table purposes at storage time, they should be sown in the late spring or early summer, according to the length of the growing season. All of the root crops should be dug carefully, and the tops should be twisted off some distance above the crown, instead of topping closely with a knife. The roots may be placed in storage in bulk or in smaller containers. All of the crops are good keepers, and are very desirable as winter vegetables. Frequently it is desirable to leave a portion of such crops as parsnips, horseradish, salsify and rutabagas in the ground over winter. In this case, harvesting is simply deferred until spring.

Cabbage.—Fresh cabbage from the home garden may be had easily until late winter. Only solid heads of the late varieties should be stored. A simple method of storage is to pull the heads with the roots attached and bury them upside down in a shallow trench. The loose outer leaves should be wrapped closely about each head. About three tiers are placed in the trench, with the second and third tiers alternating between the roots of the first. The pile is then covered with earth and straw. Another method is to pull the heads with roots on and set in an empty cold-frame or hotbed. This latter method is also satisfactory for brussels sprouts and cauliflower.

Greens.—Spinach, endive, kale and lettuce can be kept for several weeks in a cool cellar. Fall plantings of these crops are uninjured by slight freezing, but before heavy frost they should be cut and stored loosely in a box or barrel in a cool cellar.

Celery.—Celery which matures late in the fall can be stored green and blanched by the process of storage. The stalks are dug with a spade, and a large portion of the roots left on each plant. These are set side by side in a shallow layer of soil or sand in the bottom of an empty hotbed or in a corner of a cool cellar. The soil is kept moist, but the plants must be kept dry, otherwise decay may set in. The plants should continue growing slowly, and since the storage place is dark, the stalks will soon become blanched. Celery is also stored extensively in trenches 2 feet deep and 3 feet wide, the green plants being set closely on the bottom of the trench, which is roofed over with boards and banked with earth.

Sweet potatoes.—This crop differs from most others in being very tender to cold, yet it can be kept easily by maintaining suitable conditions. The tubers should be dug before heavy frost, and handled with great care, as slight bruises may bring about decay. The tubers should be air-dried before going into storage; and a further curing is desirable, if a well ventilated room is available where a temperature of 85 degrees can be maintained for ten days. After this period sweet potatoes should be kept at a temperature of 50 to 55 degrees F. A warm house cellar or shelves near the heating system is the best place to keep sweet potatoes for home use. They should be stored in boxes which hold about one bushel, and should not be rehandled or sorted over in storage. Slight shriveling of the tubers is not objectionable.

Pumpkins and squash.—These vegetables have the same temperature requirements as sweet potatoes and should be stored in the same way. They should be ripened on the vine, or by leaving in the sun several days after being picked from the vines. The Hubbard and Cushaw varieties of squash may be kept easily in perfect condition until the middle of May.

Onions.—This crop requires cold dry storage with free ventilation. It may be kept satisfactorily in a cool cellar if the bulbs are spread out thinly, or are placed in shallow crates or trays. The bulbs should be thoroly air-dried in the open and a further preliminary curing should be given by placing the onions in shallow crates in an open shed or corn crib until freezing weather comes on, when they should be placed in the cool cellar. Onions grown from sets or transplanted plants are poor keepers. Storage onions should not be topped until removed from storage. Garlic and multiplier onions may be stored in the same way as onions or they may be left in the ground over winter.

Tomatoes.—Just before or early in the morning after the first frost in fall all the green and partly ripened tomatoes should be gathered from the vines and placed in the cellar. These will ripen slowly over a period of three or four weeks, depending on the temperature. Another satisfactory method is to pull the vines loaded with the unripened fruit. These vines are hung in a cellar or are laid in a hotbed or cold frame, where they will ripen the fruit during the succeeding six weeks. This fruit is of fair quality, and is especially appreciated after the other fresh vegetables are gone.

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UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

AGRICULTURAL
EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 54 COLUMBIA, MISSOURI NOVEMBER, 1918

Prevent Insect Damage

C. C. Hamilton

The hungry world needs all the food American farmers can raise. Don't waste it by feeding armies of insects.

THE HESSIAN FLY

Question.—Is there likely to be any Hessian fly damage to our 1919 wheat crop? *A.*—The Hessian fly is so scarce now that it will take one or two years for it to become numerous enough to do any noticeable damage. Look out for trouble in the spring of 1920.

Q.—Is there any reason for following the usual practices to control the Hessian fly when the fly is very scarce? *A.*—Yes. The time to control the fly is when it is scarce, rather than after it becomes numerous enough to do damage to the wheat. Never let it get started and there'll never be any fly. Besides, the control measures recommended are good farm practices that ought to be followed whether the fly is present or not.

Q.—What are the control measures? *A.*—Deep plowing in July or August, thoro cultivation of the soil to prepare the seedbed and to keep down volunteer wheat, sowing on or about the fly-free date, and cooperation among all the farmers in a community.

Q.—What are the approximate fly-free dates for the various sections of the state? *A.*—The fly-free date for the northern part of the state is October 1, that of the southern part of the state is October 17. The approximate fly-free date for counties in the other parts of the state may be determined by finding its relative position in the state and comparing this with dates between the first and eighteenth of October. For more accurate information write to the Agricultural Extension Service for charts showing the fly-free date in each of the counties.

Q.—After the wheat is infested can anything be done to control the Hessian fly? *A.*—No. If the wheat is badly infested so as to ruin the crop it should be plowed up in the spring and planted to some other crop.

Q.—How can we tell whether wheat is infested with the fly or not? *A.*—Examine the wilted and sickly looking plants for maggots or the flaxseed stage. These will be found at the base of the wheat plant between the stalk and the sheath of the outer leaves. Pull the wheat plants up and strip down the outer leaves. If the wheat is infested, the fly will appear as a small white maggot about one-eighth of an inch long, or as the brown flaxseed stage which is also about one-eighth of an inch long. This examination should be made not earlier than the first of November. If in doubt as to whether wheat is infested, pull several large handfuls and take it to your county agent or send to the Agricultural Extension Service, Columbia, Missouri, to be examined.

THE CHINCH BUG

Question.—May we expect damage from the chinch bug next year? *Answer.*—If the chinch bug was present in wheat or corn this year, one may expect some damage next year.

Q. What can be done now to prevent this damage? *A.*—The majority of the chinch bugs pass the winter in clumps of bunch grass found along roadsides, railroad rights of way, and in other waste places. This should be burned over the latter part of November or early December thus killing many of the bugs and exposing the remainder to the cold during the winter. Care should be taken to burn at a time when the clumps are dry enough to burn close to the ground.

Q.—Will the chinch bugs winter over in shocks of corn, piles of hay or rubbish? *A.*—If the corn shocks are left standing in the field until some time in March many of the bugs will come thru the winter alive. Most of those wintering in small piles of hay, rubbish, etc., will be killed as these places usually get moist or wet during the winter and the freezing kills the bugs. The chinch bugs are very numerous in the fall and they attempt to winter in any place which furnishes dry shelter. Unless the winter is mild, only those which crawl into the clumps of bunch grass remain alive until spring.

Q.—How can one tell whether the clumps of bunch grass have chinch bugs in them or not? *A.*—Anytime after one or two killing frosts examine the bunch grass by taking some of the dry leaves, mold, etc., in the center of the bunch and next to the ground and rub it between the hands and smell for the characteristic chinch bug odor. It is also well to take a white cloth and spread out on it the loose material at the crown of the bunch grass and some of the top soil. While warming this at a fire the bugs will begin to crawl and can be easily seen. All trash and rubbish should be examined and if bugs are found it should be burned. Where possible all the farmers in a community should cooperate in the burning as the bugs from one unburned area will scatter in the spring to places which have been burned over.

Q.—Can one tell in the spring whether the chinch bugs will be numerous or not? *A.*—If they are seen flying in the spring they will probably be numerous enough to do some damage. They fly to the wheat where the eggs are laid and the young grow to maturity. After they have got into the wheat in the spring nothing can be done to get them out of it. They become full grown about the time wheat is cut at which time they begin to migrate to corn and other green feed. If numerous shortly before harvest means for preventing their migrating from the wheat should be used.

Q.—What should be done to prevent their migrating from the wheat fields to corn? *A.*—A dust barrier, consisting of a furrow with dusty sides, and post holes in the furrow at intervals of several rods, should be run between the wheat and the corn field to prevent the bugs migrating into it. If rainy or wet weather interferes with the effectiveness of the dust barrier, a barrier consisting of a narrow strip of coal tar or road oil may be used. Every county agricultural agent knows how to fight the chinch bug. Get him to help.

Q.—If chinch bugs once get into the corn field can we do anything to get rid of them? *A.*—If not too widely scattered over the field the corn may be sprayed with kerosene emulsion or soapy water, which will kill many of the bugs. It is much cheaper and easier to burn them in the fall and in the summer to prevent their migrating to the corn than it is to get them out of the wheat or corn after they once get in.

Q.—Can we kill the bugs by inoculating them with the chinch bug fungus, sometimes spoken of as "chinch-bug disease"? *A.*—Nothing can be done by artificial inoculation. The disease is present in all fields and if several days of warm, damp or rainy weather occur in the spring, the fungus will begin to kill the chinch bugs. If the weather conditions stay just right for a long enough time the bugs may all be killed. The sure and simple way to get rid of chinch bugs is to burn them in the late fall.

CORN EAR-WORM

Question.—What is the life history of the corn ear-worm which causes the corn to mold so badly in the fall? *A.*—The worms pass the winter in the larval or pupal stage in small cells or cavities in the ground. These are from three to six inches below the surface. The moths come out in the spring and begin to lay eggs usually about the time the corn is from four to eight inches tall. The second brood of moths emerge and lay eggs about the time the corn is in silk, and the third brood about the time the corn is just past the roasting ear stage. There may be a partial fourth brood which damage the corn when it is hard and before gathering time.

Q.—What can we do to control the corn ear-worm? A.—Since the corn ear-worms pass the winter in small holes or cells in the ground and not more than six inches deep they can be destroyed by deep fall or winter plowing. The plowing breaks the cells allowing the soil to come in contact with them, and the freezing and thawing during the winter kills them. Those that are not killed during the winter are buried so deep they cannot escape in the spring.

Q.—Will early plowing in the spring do any good? A.—Plowing deep before the latter part of March will help but will not be as beneficial as plowing in the fall. It is the freezing and thawing that does the most damage to the worms. Plow in the fall if at all possible to do so.

Q.—If one farmer plows and his neighbor does not will it do any good? A.—Yes. But since the moths may fly from one field to an adjacent field all the farmers in a community should cooperate. A few moths early in the spring may mean a serious injury in the fall after three broods have matured.

Q.—Does the time of planting the corn have anything to do with corn ear-worm injury? A.—Corn planted early in the spring after there is no danger from frost will mature earlier and thus escape late injury. If you can get your corn to silk before the second brood of moths appear to lay their eggs the ears will not be as badly infested. The moths prefer fresh silks to lay their eggs on instead of dried silks. Further, if you can get the corn to mature early there is not so much damage done by the third brood of worms. The later the corn the more worms there will be to help ear it.

Q.—Can anything be done to poison or kill the worms or moths in the spring? A.—Practically nothing. Some attempts have been made to poison the worms by dusting arsenate of lead on the silks at silking time. In some cases this has given good results, in other instances it has not. At any rate, it is not practicable. The best method is to plow the corn fields in the fall, winter, or very early spring.

Q. Does this worm injure other crops? If so, how can it be controlled? A.—Yes; it often injures tomatoes, tobacco, and cotton. The best means of controlling it is by fall plowing, as for corn. Spraying with arsenate of lead may be used in some cases.

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A. J. Meyer, Director

CIRCULAR 55 COLUMBIA, MISSOURI NOVEMBER, 1918

The Winter's Feed Supply

S. T. Simpson

Question.—What is the general condition of Missouri's feed supply for this winter. *Answer.*—Missouri's winter feed supply is short and of poor quality with but few exceptions. The monthly crop report of the U. S. Department of Agriculture estimates Missouri's corn crop for this year at 149,221,000 bushels as compared with 210,170,000 bushels quoted as a normal corn crop. The 1918 oat yield is quoted at 43,083,000 bushels compared with a normal crop of 52,540,000 bushels. This year's estimated production of clover hay is placed at 640,000 tons, or less than 2 tons per farm on Missouri's 337,000 farms. A normal crop of clover hay for Missouri is placed at 780,000 tons. The estimate on alfalfa and timothy is not available but indications are that both alfalfa and timothy are short, especially the latter. Stalk fields are of poor quality. Those who were fortunate enough to have silos were able to save their corn crop at its maximum value. Silage, however, with few exceptions is not as rich in grain as usual, consequently it is less valuable for feeding purposes.

Q.—What effect will these conditions have on the operations of the various classes of stockmen? *A.*—Owners of young stock which need legume hays and grain to produce bone, muscle and vital organs, and finishers of meat animals requiring considerable corn, may find difficulty in continuing their normal operations. Among the purebred breeders the greater difficulties will appear in the proper maintainance and development of young and growing animals. Sheep breeders who are used to legume hays will in some cases have to resort to grain feeding along with available roughness to insure proper feed for maintenance. Cattle feeders may change their practice, substituting various concentrates and manufactured feeds for grain and enlarge the amounts of roughages such as silage and thus reduce cost.

Q.—What factors other than feed may contribute to the cost of maintenance and fattening? *A.*—Proper protection from wind, rain and snow storms, and a dry, comfortable bed for all stock, will save feed. Liberal feeding cannot replace shelter entirely, and such a practice will prove an economic loss. Stock in the fattening pens will respond to clean, dry beds and shelter, but they will not respond greatly to more than ordinary protection. The Missouri Experiment Station showed that fattening steers fed in open, well-bedded sheds gained faster and more economically than those confined in a closed barn. The Kansas Agricultural College found that during a winter with temperature ranging as low as twelve degrees below zero large hogs in warm quarters required twenty-five percent less feed than those protected only by a high board fence on the north.

Special shelter for young animals at time of birth will greatly reduce the ordinary losses occuring at such critical times. The animal body may be compared to a furnace which radiates heat. The feed fed corresponds to the fuel of the furnace. In animals the greater the radiating surface per hundredweight the greater the amount of feed necessary for maintenance of the body temperature. In young animals this surface is greater in proportion to weight than in larger and older animals. Consequently, young and growing stock use a greater percentage of their feed allowance for maintaining body heat than do older animals, and therefore, shelter may be of greater significance to the young stock.

It is important that animals of all classes be provided with clean fresh water at all times. Water contributes to the normal growth and development and to proper maintenance and fattening. It enters into the digestion and assimilation of nutrients taken into the body, and later, into the formation of tissue. An ample supply even in winter will mean more efficient use of feeds. Seldom will it pay to heat water for animals in normal condition when it can be had direct from the hydrant or well.

Q.—How may hay and grain be saved? *A.*—Much of Missouri's early sown wheat may be pastured moderately without harm. Brood sows, breeding ewes and young stock of all kinds will make especially valuable use of the surplus growth in the wheat fields. Rye is also a favorite fall and winter pasture. Rye and wheat pastures, not only provide the nutrients which insure proper development of growing animals but they lend succulence to the ration, which is always a factor in the economical maintenance and production of meat animals. As forage these crops are comparatively rich in the protein and mineral elements used in the building of bone and muscle or body framework.

Well-grown meadows will furnish winter pastures in many instances in sufficient quantity to maintain idle work stock and stock cattle until snows cover the grass.

Work at the Missouri Experiment Station with brood mares and draft geldings indicates that oat straw may take the place of timothy hay for horses and mules. At the Illinois Station, Coffey secured slightly better gains on sheep with oat straw, stover and corn than with stover and corn but not as good gains as were secured by feeding alfalfa hay and corn. Straw is not a satisfactory feed for sheep. At the Hays Kansas Branch Station good results were secured by feeding Kafir silage and wheat straw and one pound of cottonseed meal per head daily to wintering beef cows. Kafir silage is less valuable as a feed than corn silage. Oat and wheat straw contain about the same amount of digestible nutrients, but oat straw is more palatable.

The Missouri Experiment Station found a full feed of silage without additional corn more economical for fattening 2-year-old steers on 130-day feed than when the silage was limited to approximately one-half and a full feed of shelled corn given. In both lots linseed meal and alfalfa hay were fed in addition. When figured on the basis of a corn yield of 40 bushels per acre the heavy silage lot produced 779.5 pounds of beef and pork while the limited silage ration and full feed of corn produced only 360.1 pounds of beef and pork per acre of corn fed. The heavy silage lot received, however, 2 pounds more linseed meal per head daily than did the light silage and corn lot. The difference in cost was such as to allow a profit of $5.33 per head more in favor of the heavy silage lot. (See Missouri Agricultural Experiment Station Bulletin 150.) Silage may also be used in wintering breeding ewes if free from mold, not too acid, and fed in quantities not to exceed 2½ to 3 lbs. per head daily, with other feeds. It is used extensively by lamb feeders in finishing lambs for market.

Idle horses and mules fed sound silage in limited quantities seem to thrive. Work at the Missouri Station indicates the possibility of wintering brood mares on silage when combined with other roughness. However, its use as a horse and mule feed must always be practiced with care. Sheep, calves and colts will require leguminous hays or other hays, or silage supplemented with protein feeds, if they are to be maintained satisfactorily.

Q.—Will it pay to purchase high protein feeds such as linseed meal, cottonseed meal, tankage, etc.? *A.*—Most farm-grown feeds with the exception of the legumes are deficient in the elements which combined are known as protein and mineral matter. These elements build bone and muscle and are the basis of growth in young animals. They also aid in bringing about complete and efficient digestion of feed consumed. The quantity of these elements in corn silage, shock corn, timothy hay and many other feeds is deficient to the extent that growing animals fed only on such feeds seldom attain their full growth and development. This makes it important that such feeds be supplemented with other feeds richer in protein and mineral matter. For maintaining mature cattle and sheep, sufficient protein may be supplied by feeding some such legume hays as alfalfa, clover or cowpeas. These roughages do not supply sufficient protein for growing animals when mixed with such other feeds as corn, timothy hay, fodder, etc.; consequently, a concentrated feed rich in protein must be purchased.

High protein feeds are just as necessary in fattening animals. While fat is seldom formed from protein yet protein so stimulates digestion that the carbohydrates which do form fat are much more economically utilized and a saving of feed results. Most fattening animals are also growing, hence the body makes still further use of the protein besides that of digestion and repair which goes on in all animals.

One ton of tankage costing $100 may be expected to save slightly over 100 bushels of corn when fed with corn to hogs. In other words an investment of $100 in tankage replaces $140 in corn, thus showing a net profit of $40 saved on an operation involving an investment of approximately $600 in feed. (See Missouri Agr. Exp. Sta. Bulletin 136.) This represents the difference between profit and loss on many droves of hogs and should be taken advantage of by Missouri farmers. Linseed meal instead of tankage may be used for hogs but is not as economical. If shorts and middlings can be secured they will prove economical and satisfactory for both breeding and fattening hogs. Brood sows and growing pigs may be expected to pay a liberal profit on investments in tankage, shorts or linseed meal.

The cattle breeder and feeder can well afford to purchase linseed or cottonseed meal and bran for supplements to the common feeds. Cattle feeders can profitably use linseed meal at $5 a ton higher in price than cottonseed, as shown by feeding trials at the Missouri Station. (Missouri Agr. Exp. Sta. Bulletin 150.) In the same experiments cattle on corn silage, corn and alfalfa hay failed to make as efficient or economical gains as those fed linseed meal, corn silage and alfalfa hay. The use of linseed meal and bran is common among horse men. Wheat bran has a feeding value approximately the same as good alfalfa hay. Other feeds which may be purchased are rye middlings, hominy feed, mill run, and other by-products of milling.

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CIRCULAR 56 COLUMBIA, MISSOURI DECEMBER, 1918

Fattening Lambs on Forage

Howard Hackedorn and W. C. Etheridge

Fattening lambs on forage that often would be wasted unless so utilized, is a practice which has proved exceptionally profitable to many North and Central Missouri farmers. This practice has one big advantage over other systems of feeding in that the cost of production is extremely low because so much cheap forage is used. The advantage of turning weeds, grasses, and surplus forage into money and manure is evident. The Missouri Experiment Station has not been able to test this method of fattening lambs. However, in order to furnish information concerning the method, the knowledge gained from the experiences of a number of Missouri farmers who have been successful lamb feeders has been summarized.

IMPROVING THE QUALITY OF FORAGE

The forage most commonly used is the undergrowth in corn fields. In many cases special forages such as soybeans, cowpeas, or rape are sown with corn to provide a better class of forage than that afforded by the weeds and grasses that naturally spring up in the corn fields. In planting these special crops, the main point involved is whether the forage crops will reduce the yield of corn and if so to what extent. Since so many factors are involved, and available data relating to this question are so limited, few definite statements can be made. General experience supports the following facts:

Soybeans planted at the same time as corn—in the hill or in the row—will doubtless reduce the yield of corn, both in grain and fodder. The degree of reduction will depend on the relative capacity of the land to support the additional crop. On very fertile land containing plenty of moisture, there would probably be little reduction in yield of either crop—corn or soybeans. It is obvious, however, that yields of both crops would be reduced on land where the fertility and available moisture were capable of supporting only the corn crop. The season also would have a direct relation to the reduction in yield, probably even more direct than that of the soil; for moisture is likely to be the chief limiting factor in the success of the double crop.

Soybeans planted in corn at the last cultivation, under conditions of soil and season ranging from very favorable to average, would probably reduce the yield but little, if any. Under conditions below the average there would probably be a reduction. In any case, the crop of beans would be comparatively light owing to shading by the corn, reduction of moisture by the corn, and the short period for growth.

As compensating factors for a reduction in yield of corn, there are:

a. The added bulk and richness of the soybeans,
b. The double use of the land,
c. The double use of cultural methods—preparation, cultivation, etc.,
d. The manure from the grazing animals.

The relation of cowpeas to the yield of corn would doubtless be the same as that borne by soybeans.

SELECTING THE FORAGE CROP

The second question concerns the forage crop to be used. Cowpeas and soybeans will thrive on less fertile soil than rape. Rape has the advantage of withstanding frost, but it requires a moist and extremely fertile soil to grow the crop successfully in a corn field. Hard frost will kill the leaves on the soybeans and cowpeas; the dead leaves drop, leaving only the seed pods and the stems. Lambs will not fatten on the stems and, unless there is an exceptionally good seed crop, will not get a great deal out of a corn field after the first few hard frosts. A combination of the two classes of feed has proved advisable in many cases. On soil not sufficiently rich to grow successfully the rape in the corn, it can be sown as a special crop to be used in finishing the lambs. Most lamb feeders prefer the soybeans to cowpeas. Soybeans stand more erect, thus giving less trouble during cultivation if planted with the corn, and being subject to less waste by lambs tramping them to the ground.

VARIETIES TO PLANT

For early planting with corn, a good variety of peas is the Whippoorwill; of soybeans, the Medium Yellow, Mikado, Morse, Wilson, or Virginia varieties are recommended. For late planting, the New Era cowpea (Blue pea) and Ito San soybean are satisfactory. When planted at the time of planting corn, the beans or peas can be dropped from the same hopper as the corn, or from a hopper on a special attachment. By the first method, beans and corn are planted in the same hills or are drilled together in the row; by the second, in alternate hills. The rate of planting the beans is ten to fifteen pounds per acre. When planted at the last cultivation, beans may be broadcast at the rate of sixty pounds per acre; or if drilled in the middles, using a one-horse planter, at twenty pounds per acre. Broadcasting seems to be the better way. However, late planting of any kind is likely to result in very little growth.

The Dwarf Essex variety of rape should be used; care being taken to obtain this variety. Where sown alone, it can be drilled in rows or broadcasted; the amount of feed produced per acre will not vary to any great extent. Six to eight pounds of seed per acre are used when broadcast and two to four pounds when sown in rows with a corn planter. If the rape is sown at the last cultivation of the corn, it can be drilled in with a one-horse drill or sown broadcast and cultivated in. The rate of seeding by either of these two methods should be from three to eight pounds per acre, according to the method used.

TYPE OF LAMBS TO FEED

The class of lambs usually purchased to utilize this forage are thin, good quality, 55-pound western feeding lambs. Some seasons this class of lambs will run a little lighter and sometimes heavier, depending upon the condition of the grass and the season in the western range country. The lambs can be bought thru reliable livestock commission firms on Kansas City, St. Joseph, and East St. Louis stock yards.

SOME FEEDING RESULTS

The following table was compiled from data gathered in 1914, by the Farm Management Department, from farmers in various parts of Missouri who fed lambs in the corn fields. It shows the gains made by the lambs, the gain in weight from market to market, and approximately the amount of feed required to fatten the lambs.

The weight when purchased refers to the weight at Kansas City or St. Joseph stock yards, where the lambs were bought. The final or selling weight represents the weight on the scales at Kansas City or East St. Louis stock yards, where they were sold. Hence the gain represents the gain from market to market and not the actual gain made while in the corn field, as the shrink from the buying point to the farm and from the farm to the marketing point is not considered. So the actual gain would be greater if the lambs were bought at home and sold at home. In the last column of the table it is shown that an average of four lambs per acre were required to utilize the forage in the corn fields and such additional forage as was supplied, as well as the 0.27 bushel of corn per head which also was fed. The average gain from market to market was 15.33 pounds.

	Gentry County Darlington		Montgomery County Wellsville		Cooper County Pilot Grove	Pettis County La Monte	Boone County Columbia	Benton County Warsaw	Average
Date purchased, 1914	September 1		September 25		September 9	September 24	September 25	October 13	....
Number purchased	350		250		149	126	160	73	1108 Total
Average weight of lambs—	Pounds		Pounds		Pounds	Pounds	Pounds	Pounds	Pounds
Per head when purchased	52.0	52.0	57	57	53.13	60	59.4	55.2	55.49
Per head when sold	71.5	66.5	65	76	68	78.5	71	73.3	70.82
Average gain per head	19.5	14.5	8	19	14.7	18.5	11.6	18.1	15.33
Days fed	70	90	46	84	60	80	50	50	68.61 (a)
Feed—									
Forage, acres grazed	Cowpeas and bluegrass,70		Cowpeas, 26; rape, 4; meadow 13		Corn and cowpeas, 20	Corn and cowpeas, 37; rape, 3	Cowpeas and corn, 36. Very weedy tame meadow pasture, 25	Cowpeas in corn field*	234 Total
Grain, bushels corn	30	100	15	60	18	45	40	20	0.29 (a)
Number shipped	140	206	111	134	147	125	158	73	1094 Total
Death loss	4		5		2	1	2	0	14 Total
Number of lambs per acre	5		5.81		7.45	3.15	2.62	*	4.42 (b)

*Area not given.

(a) Calculated on basis of number sold.

(b) Calculated on basis of number purchased.

NUMBER OF LAMBS TO BUY

The number of 55-pound western feeding lambs per acre necessary to utilize the undergrowth in corn fields will vary with the condition of the forage, the season and class of lambs. When the undergrowth in the corn field is depended upon as the main feed, for a single-deck carload of 150 to 160 lambs, one should plan to have 35 to 45 acres of corn in which beans or peas have been planted. With a good stand of rape in the corn, particularly on rich bottom lands where the corn has not been planted thick or a poor stand has been obtained, 20 to 30 acres (in some cases less) will furnish sufficient feed for a single-deck carload of lambs. When cowpeas or soybeans are used as a feed it is advisable to have a small plot, 3 to 4 acres, of rape to finish the lambs on after the hard frost has destroyed most other forage.

GENERAL MANAGEMENT OF THE FLOCK

Lambs must be accustomed gradually to rich green feed like rape, soybeans, or cowpeas. The method commonly used is to put the lambs on a comparatively dry timothy or blue grass pasture upon arrival at the farm. Here they are allowed to rest and fill up on grass for a couple of days. An abundance of good clean drinking water should be provided at all times. After a day or two the lambs are turned into the corn field for about an hour, following their morning fill of grass. They are then returned to the bluegrass or timothy pasture. This operation is repeated for three or four days, and the time the lambs are allowed in the corn field is increased about an hour each day.

It is not easy to drive a load or two of lambs out of a large corn field, and there is always the danger of leaving behind a few which have strayed from the main flock. To avoid this trouble, fence off "sheep tight" a plot of two or three acres. In this plot grow forage to be used to gradually accustom the lambs to their regular forage in the larger field. This plan will be found very convenient.

The lambs will eat the lower blades of the corn and will learn to eat the "down corn." However, they will not become troublesome by breaking down the stalks in order to get to the ears, if sufficient feed is provided. If it is desirable to pasture off the grain in place of husking out the corn, it will be necessary for best results to break the stalks for the lambs. If this plan is used, just enough stalks should be broken each day to furnish grain to satisfy the lambs. The lambs will waste the corn if too much is broken down for them at one time.

"No one ever made sheep fat by stinting them." It should be remembered that as the fall season advances, feed becomes scarce and unpalatable. If the lambs are to be marketed as fat lambs, it follows that they should not be forced to remain in the corn field too long without some additional feed. This is particularly true where rape is not available. In Central Missouri it will be necessary about November 1 to begin feeding some grain in addition to the forage. Many feeders also feed hay at this time, giving the lambs each evening as much as they will eat before morning. A few of the larger feeders begin feeding corn silage about November first. As much silage as the lambs will eat up clean in about an hour, is the right amount to feed both morning and evening.

Salt should be kept before the lambs.

Good water should be supplied for the lambs.

Shed or barn shelter is not absolutely necessary, but if practicable, it is advisable to have shelter to protect the lambs from the cold fall rains.

One of Missouri's prominent sheep feeders says: "The successful feeder is ever on the watch for things to happen. Sheep do not require a lot of attention but they pay one well for seeing that their wants are punctually and regularly attended to."

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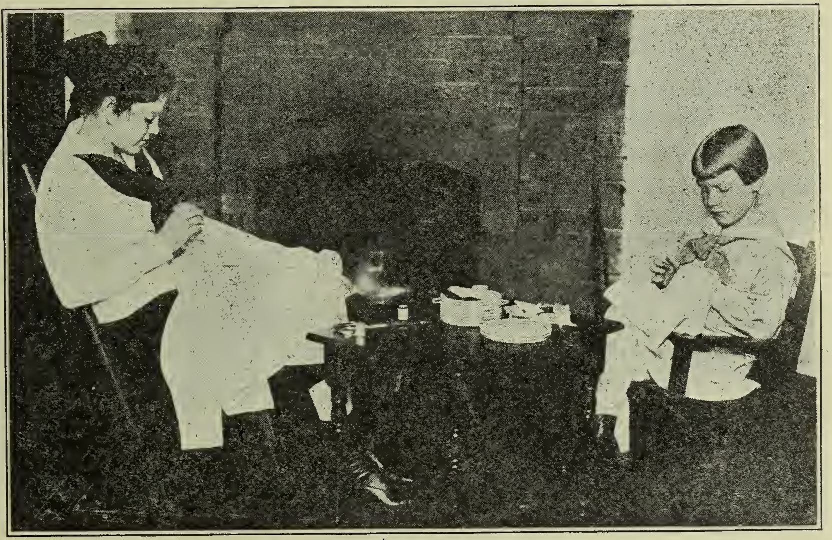
CIRCULAR 57 COLUMBIA, MISSOURI JANUARY, 1919

SEWING COURSE III

Making a Simple Wash Dress and Middy Blouse

Addie D. Root



A profitable employment for spare hours

Every girl should endeavor to be well dressed. This does not demand the purchase of an abundance of clothes of the latest fashion. Large sums of money may be spent on the wardrobe and the result be an absolute failure. In order to be well dressed one must be well groomed, which means first of all, perfect personal cleanliness. The hair should be clean, well brushed, and combed in a style suited to the age of the girl. If hair ribbons are used they should be clean and pressed, and of a color which will harmonize with the dress. Black hair ribbons for general wear are always in good taste. Teeth should be brushed, and nails trimmed and clean. Shoes and stockings should be of one color. Black and tan shoes, always in good taste, are the most practical for all around wear, and should always be polished and neatly laced or buttoned to give a good appearance. If white shoes are worn it should be with light clothes, and great care taken to keep them clean. Shoes of an extreme style and with high heels will detract from the appearance of an otherwise well dressed girl, and are very detrimental to good health. All garments should be clean, pressed and mended, and suited to the occasion on which they are worn. It is better to plan a complete, simple wardrobe where all garments harmonize than to combine very plain with elaborate things. Simplicity is the first essential to elegance. Endeavor to have a simple, harmonious wardrobe that will meet all needs. A carefully planned wardrobe and a well groomed person will produce the effect that is really the desire of every girl's heart, which is, to be well dressed.

SIMPLE WASH DRESS

Design.—Two-piece dress, Russian blouse. Waist and plain three- or four-piece skirt.

Material.—Kind: Gingham, percale, chambray, kindergarten cloth, or any wash material appropriate for a school dress. Amount: Buy the amount of material required for size of pattern in scale for buying material. Thread: No. 70 for stitching; No. 50 for buttonholes.

Pattern.—Buy a commercial pattern, plain Russian blouse design, of a standard make. These have clearly marked directions for use. To insure buying a pattern of the correct size, the following measures should be taken:

WAIST. *Bust measure.*—Stand behind the figure, keeping the tape line straight across the back. half wav between bone in back of neck and the waist. Measure around the fullest part of the bust. Do not draw tight but take an easy measure.

Length of back.—Place a tape around waist to mark the waist line. Measure from bone at base of neck to bottom of tape around waist.

Length of front.—Measure from hollow of neck to bottom of tape at waist.

Sleeve length.—Measure outside length taken from bone at shoulder to wrist bone over bent elbow and inside of armhole or hollow to wrist.

SKIRT. *Waist.*—Take a snug measure with tape line lying flat.

Hip.—From six to nine inches below the waist line in front, measure around the fullest part of hip over hip bone, parallel to floor.

Length.—Measure from bottom of tape around waist to the floor in the center front, on hip and in center back.

Testing pattern.—Buy waist or dress pattern according to bust measure, and skirt pattern according to hip measure.

Before opening, see that the pattern is the correct size.

Open pattern. Select the pieces needed, fold others and replace in the envelope. Note the seam allowance and how indicated.

If pattern needs alteration, note Figures 1 to 14. Cut on dotted line and spread pattern to lengthen, or fold on dotted line to shorten.

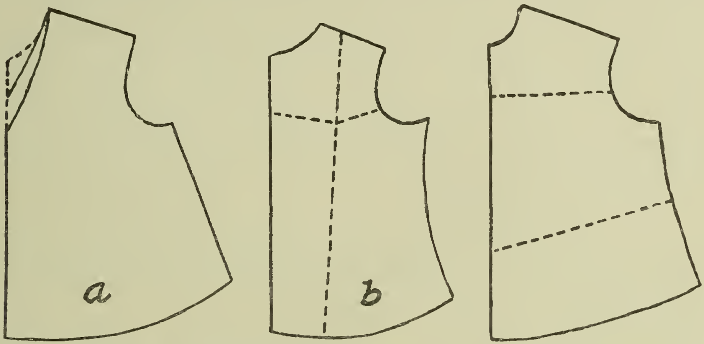


Fig. 1.—To alter front of waist pattern: *a*, neck; *b*, to enlarge or decrease bust; *c*, to make longer or shorter

Test front by holding it to the neck. Is neck too low or too high? Alter according to Figure 1, *a*.

Is pattern too narrow or too wide across bust? Alter according to Figure 1, *b*, on dotted line running from arm hole.

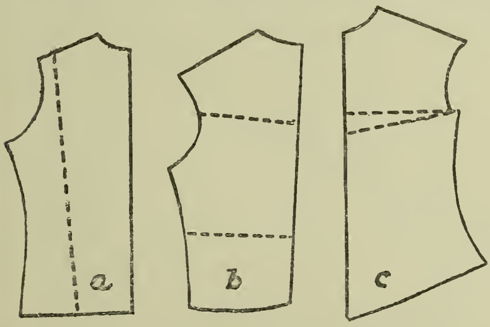


Fig. 2.—To alter back of waist pattern: *a*, to make wider or narrower; *b*, to make shorter or longer; *c*, for round shoulders

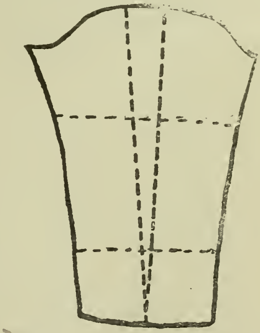


Fig. 3.—To alter length or to take fullness out of sleeve

Test back in the same manner by holding to neck in back and alter according to Figure 2, *a*, *b*, *c*.

Test sleeve by holding it up to arm to determine if it is the right length or large enough. Alter according to Figure 3.

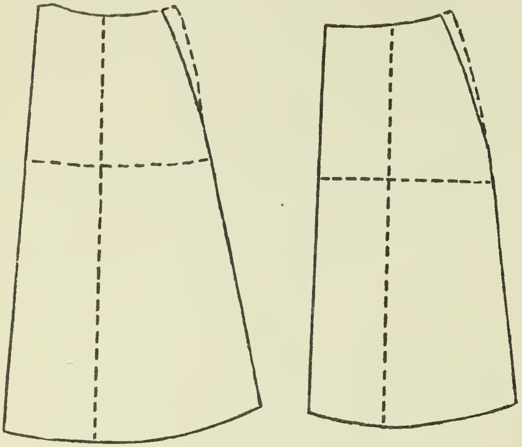


Fig. 4.—To alter length and waist measure of skirt pattern

Test the length of skirt by holding the front to waist. If less than two inches too long take off the bottom; if more than two inches alter according to Figures 4 and 7, *a*.

Preparation of material.—Shrink the material before using. This may be done by placing in cold water without unfolding and allowing it to soak for twelve hours. Use enough water to cover material completely. Remove from water and place on line to dry without unfolding or ringing out the water. Press when nearly dry.

If a colored material is being used which is likely to fade set the color while shrinking by adding one tablespoonful of turpentine for each gallon of cold water in which the material is soaked.

SKIRT

Placing pattern.—Lay pattern on goods. Care should be taken not to waste material. Always lay largest part of pattern toward the cut end of material in order to cut to advantage. (*See* Figure 5.)

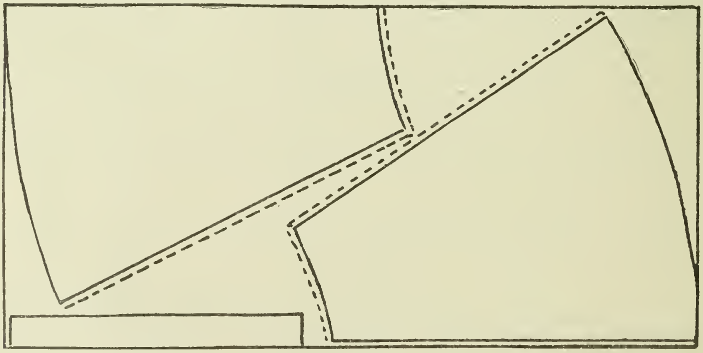


Fig. 5.—The skirt pattern in place on the dress material

When there is a right and wrong side the material is folded lengthwise so that the two right sides come together, or if material is narrow open out material and place two cut ends together, provided there is no "up and down" in goods. All goods must be laid with the tops of the figures in goods running in the same direction. Pin each piece in place carefully. Instead of cutting a notch in the goods, take a stitch in it.

Cutting.—Cut with sharp shears close to pattern if seams are allowed. If seams are not allowed mark allowance with chalk or pins before cutting.

Making.—Sew front gores together, first making plait down the front not more than one and one-half inches wide. The middle of the plait should run exactly down the center front. If both fronts are cut on the selvage the front seam will not require finishing on the wrong side. In order to do this the fronts must be cut separately since the allowance for a plait must be left on the right front only.

Baste side seams at least one-half inch deep with seams on the right side. Fit skirt and make any alterations necessary before stitching, unless it is gathered in the back.

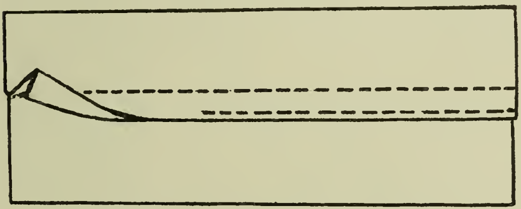


Fig. 6.—A stitched felled seam

Finish seams, making a stitched fell-seam. (*See* Figure 6.) All seams should turn to back of skirt.

To make a stitched fell-seam.—Have the wrong sides of the cloth together with edges together. Stitch three-eighths of inch from edge so that upper side of stitching will come on top of the unfinished seam, or toward the front of the skirt. Trim the under side of the seam to one-eighth inch. Make one-eighth inch turning on wide edge. Baste the wide edge flat over the narrow one on the cloth, keeping the underside of the seam smooth. Stitch close to the edge.

Putting on belt.—Place right side of belt to wrong side of skirt, after turning ends of belt in one inch, and stitch one-fourth inch from edge. Turn band to right side of skirt and make one-fourth inch turning. Place edge over the line of stitching, being sure that ends meet. Baste in place carefully and stitch around edge of band on the right side.

Sewing on fasteners.—Sew snaps on opening down front and on belt, using the button hole stitch.

Making Hem.—To mark line for hem, use a yardstick for straightening the skirt around the bottom. Place the yardstick on end on the floor, keeping it perpendicular. Measure up from the floor the distance skirt is desired from floor and mark line for bottom of hem by placing pins. Place pins not more than one inch apart in order to get the correct curve of the skirt around the bottom.

Turning the hem.—Take off the skirt carefully so as not to lose pins and turn goods to wrong side on line of pins, basting carefully one-fourth inch from fold. (*See* Figure 7, *a.*) Side seams should be carefully folded back on themselves so that the seams match.

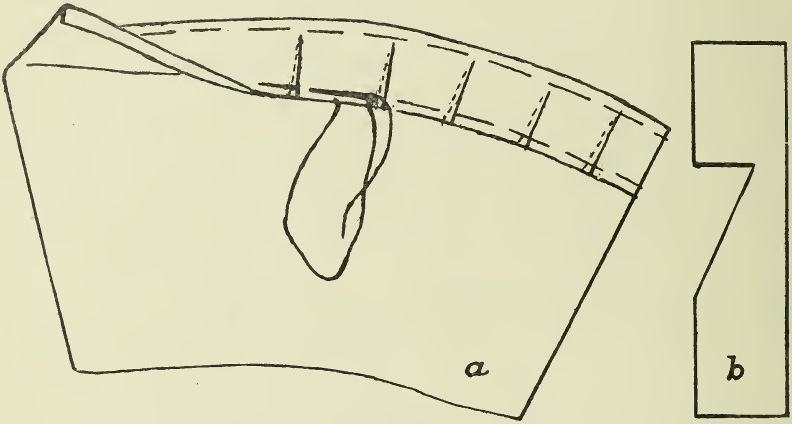


Fig. 7.—Skirt: *a,* Basting the turned hem; *b,* gauge for making hem

Cut gauge for making hem in skirt out of card board according to Figure 7, *b.*

Using the gauge, mark the hem evenly, holding the gauge at right angles to edge of hem. Cut on pencil marks. Place skirt in lap with hem on table. Make a one-fourth inch turning on edge. Baste hem down carefully, taking out the fullness by small darts turning to the right to make stitching of hem easy. (Fig. 7, *a.*)

RUSSIAN BLOUSE WAIST

Placing pattern.—Place the waist pattern on the goods so as to cut as economically as possible. (*See* Figure 8.)

Place fronts allowing for hem on each side with edge of fronts on selvage. If selvage is heavy; trim.

Place back with center back on a lengthwise fold.

Place sleeves lengthwise of the goods, according to perforations in pattern.

Place collar on a double thickness lengthwise with goods.

Place cuffs on double thickness, lengthwise of goods.
Place belt on lengthwise fold.

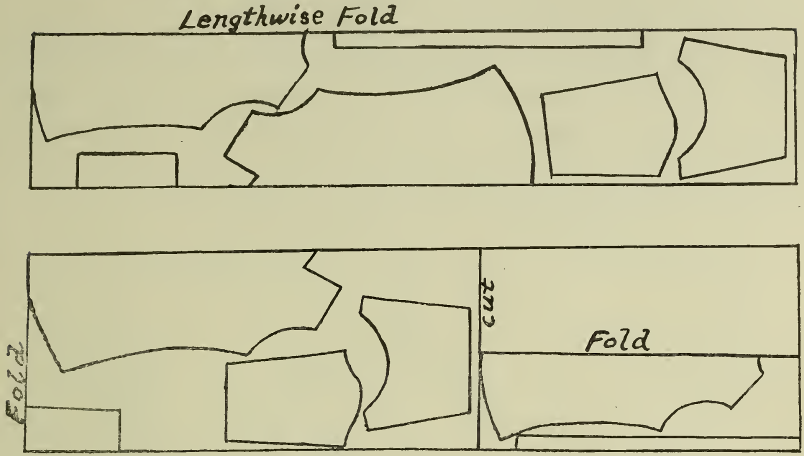


Fig. 8.—Suggested plan for laying the waist pattern in place on the dress material

Cut carefully with sharp shears close to pattern, if seams have been allowed.

Making. *Basting.*—Baste hems down the front.

Baste shoulder seams the depth indicated on pattern with seams on right side. Pin under arm seams. Try on the waist.

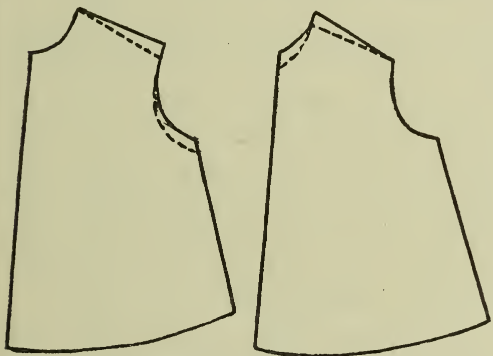


Fig. 9.—Taking up shoulder seam, front and back, to make waist fit snugly

The line of shoulder seam should be taken up or let out if necessary until the waist fits comfortably and smoothly around neck, chest and back. (*See* Figure 9.) Remove pins from under arms seams and prepare to stitch.

Stitching shoulder seams.—Stitch shoulder seams, making a stitched fell-seam, turned toward front. Right side of stitching should show on the seam.

Putting in sleeves.—The position of the sleeve in the armhole is indicated by small notches in the top edge of the sleeve and in armhole. Match these notches.

If the under arm seam in the sleeve is not continuous with under arm seam in the waist, finish the under arm seam in the waist first, making a stitched fell seam turning to the front.

If the under arm seam is continuous place sleeve in armhole before sewing under arm seams, as follows: Pin sleeve into waist working back the fullness with the left thumb. There is usually about two inches of fullness. Pin with sleeve side up and seam on right side. Baste carefully and stitch on waist side. Make stitched fell-seam with fold turned over sleeve. (*See* Figure 10.)

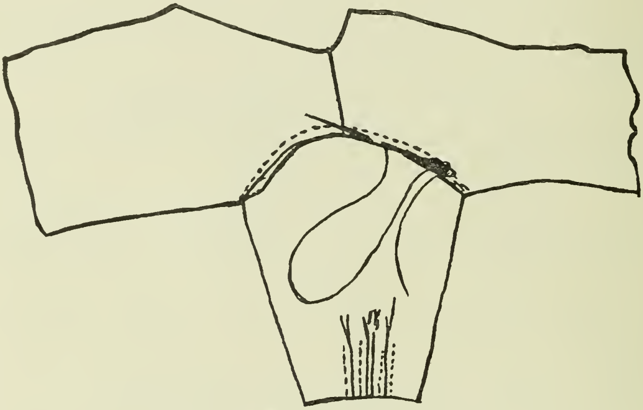


Fig. 10.—Setting in the sleeve

Finish under arm sleeve-and-waist seam by making a continuous french seam or stitched fell.

Putting on collar.—Sew double thickness of collar with right sides together around the edge, making one-fourth inch seam and leaving the neck side open. Trim seam, turn right side out and baste around the edge to within an inch of the opening on each side.

Stitch underneathside of collar to neck of dress with one-fourth inch seam. Turn top side of collar under and stitch over the first line of sewing. Stitch around collar one-eighth inch from edge.

Putting fastenings on front of waist.—Place a button near the top of the left front hem and divide the rest of the space evenly for the buttons.

Work buttonholes crosswise of hem to fit the buttons.

Making belt.—Fold the right sides together and stitch all around the edge except at one end, making a one-fourth inch seam. Clip the corners and turn right side out. Turn in one-fourth inch on open end and stitch around entire edge one-eighth inch from edge.

Placing belt straps.—Make straps one-half inch wide when finished and as long as belt is wide plus one-fourth inch at each end to turn in. Turn in ends and stitch around edge. Baste to dress at waist line on under arm seams. Stitch across ends twice. Place belt in straps and measure for fastening. Place buttons and buttonholes on belt in front.

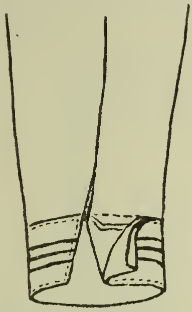


Fig. 11.—Finishing the sleeve

Finishing sleeves.—Make cuff by folding the goods together crosswise and sewing one-fourth inch seam, leaving it loose enough to slip over the hand easily. Fold back, making the cuff double with seam on inside.

Prepare bottom of the sleeve for the cuff by gathering or laying plaits. Do not allow them to come within one and a half inches on either side of the under arm seam. (*See* Figure 11.)

Place seam in cuff to seam in sleeve and baste underneath raw edge of cuff to sleeve. Care should be taken to keep any plaits in sleeve at right angles to edge of cuff. Fold back the outside raw edge of cuff and baste over first line of basting. Stitch around both edges of cuff on right side.

Placing hem in bottom of waist.—Make a one and one-fourth inch hem around bottom of waist, measuring with a yardstick from floor in the same manner as described in making hem in skirt. The hem is turned, basted and sewed in same way as described in skirt.

MIDDY BLOUSE

Material.—Galatea, duck, khaki, serge or flannel.

Thread.—No. 70 for stitching, No. 50 for buttonholes; twist, if serge or flannel.

Trimming.—Braid, cotton or linen not wider than one-fourth inch.

Pattern.—Size of bust measure. Style as near that of the regulation middy blouse as possible.

Pattern.—Test pattern as given in directions for wash dress.

Place pattern on goods as economically as possible as given in directions under Russian blouse waist. The separate pieces for the double collar are cut with center back lengthwise with goods. The collar facing, which is the upper side of the collar when finished, and front facings are in one piece and are cut one-eighth inch wider than collar on sides and lower edge, as illustrated in Figure 12, *b*.

Making.—Cut out front, back, collar, sleeves, cuffs and pocket.

Stitching shoulder seams.—Baste and stitch shoulder seams as given under Russian Blouse waist.

Putting on collar.—Sewing on underneath collar: The notches in the collar pattern are marked showing where it joins the neck of the blouse. Baste the lower piece in place, matching the marks exactly. Stitch the seam. (*See* Figure 12, *a.*) Press the seam open and stitch close to each side.

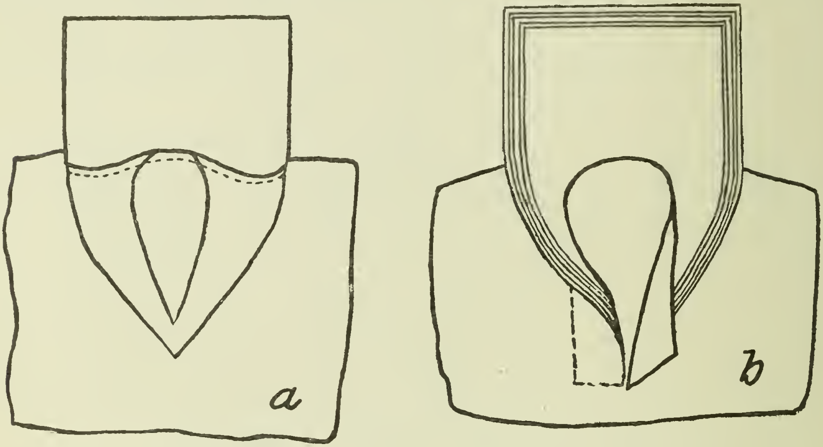


Fig. 12.—Putting on collar: *a,* sewing underneath; *b,* sewing on facing

Preparing the top collar or collar facing: Mark the allowance left for the seam on the edge of the collar with a basting thread. Baste in place three rows of braid. The outer row should be one-half inch from edge of the collar. The rows should be as far apart as the braid is wide.

Mitre the braid at the corners of the collar. To make a mitre, fold the braid on itself so that the edge of the braid is running at right angles and is forming a diagonal line at the corner. In making the mitre turn the fold in opposite directions in the two corners of the collar. Baste both edges. Stitch both edges of the braid. If a newspaper is laid under the collar it will aid in keeping the braid straight on the collar while stitching, and may be easily removed after stitching.

Embroider star in each corner of the collar if desired.

Place the right side of the collar facing to the right side of the collar. Baste and stitch around the sides and the lower edge, leaving neck open. Cut off seams one-eighth inch from stitching and cut corners diagonally across. Turn right side out and pull out corners with a pin if necessary. The inner edge of the collar facing must be turned in three-eights of an inch and basted. Stitch around the neck and down the front, thus finishing the front facing. (See Figure 12, *b*.)

Setting in sleeves.—Blouse should be laid out flat upon the table for convenience in setting in the sleeves. Follow directions for placing sleeve in armhole as given for Russian Blouse. (See Figure 10.)

Measure bottom of sleeve and the cuff. Divide the difference into sixths and lay six small plaits in the sleeve the depth of cuff as indicated in sleeve (Fig. 10), to make the cuff fit. Lay the plaits toward the center, three one way and three the other, and stitch along the edge of the fold.

Finish the under arm seam by making a continuous french or flat fell-seam leaving two and one-half inches at bottom of sleeve for a placket. Finish the placket by making a small hem on each side.

Cuffs.—Sew braid on cuff, one row running thru the center of the upper half and one on each side of center row, the width of the braid apart. The ends of the braid will turn back in seams. Fold cuff lengthwise with the right side in and stitch the ends of the cuff. Turn right side out. Join the under edge of the cuff to the sleeve with seam toward the outside. The top edge of the cuff is turned under and basted over the seam. The cuff is then stitched on the edge on all four sides. (*See* Figure 11.)

Placing pocket.—A patch pocket may be placed on the upper left-hand side, six inches down from shoulder seam and two inches in from armhole. Turn hem across top of pocket and stitch. Turn in other sides of pocket and baste ready to stitch. Baste pocket in place and stitch around the edge twice, one-fourth inch apart. Begin stitching one-half inch from the top of the pocket on side and stitch to the top; turn and stitch back down the edge on the same line of stitching. Finish stitching in same manner.

Finish bottom.—Turn a three-quarter inch hem in bottom with under arm seams turning to the front. Baste and stitch.

Fasteners.—Two buttons and buttonholes should be placed on each cuff. Buttons should be on the underneath side. If desired, eyelets may be worked at neck to run cord thru for lacing up the neck.

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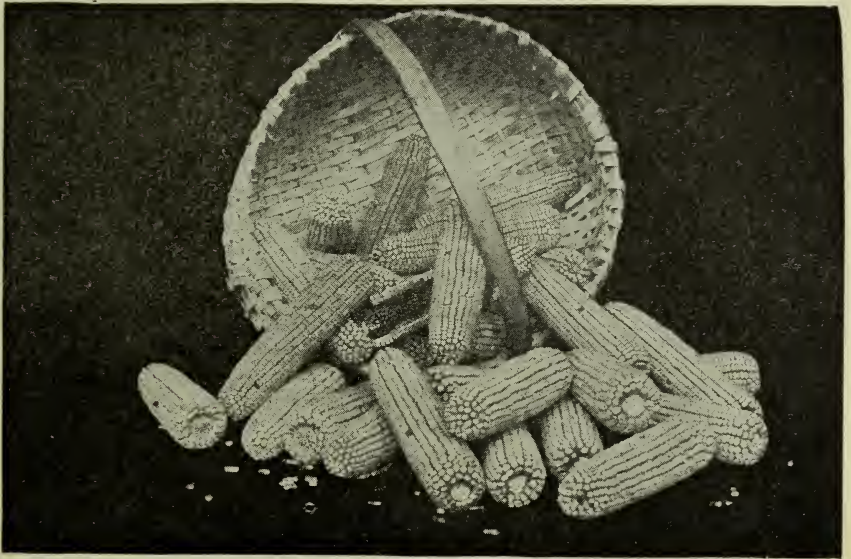
CIRCULAR 58 COLUMBIA, MISSOURI JANUARY, 1919

Grain Judging for Boys' and Girls' Clubs

Geo. W. Reavis

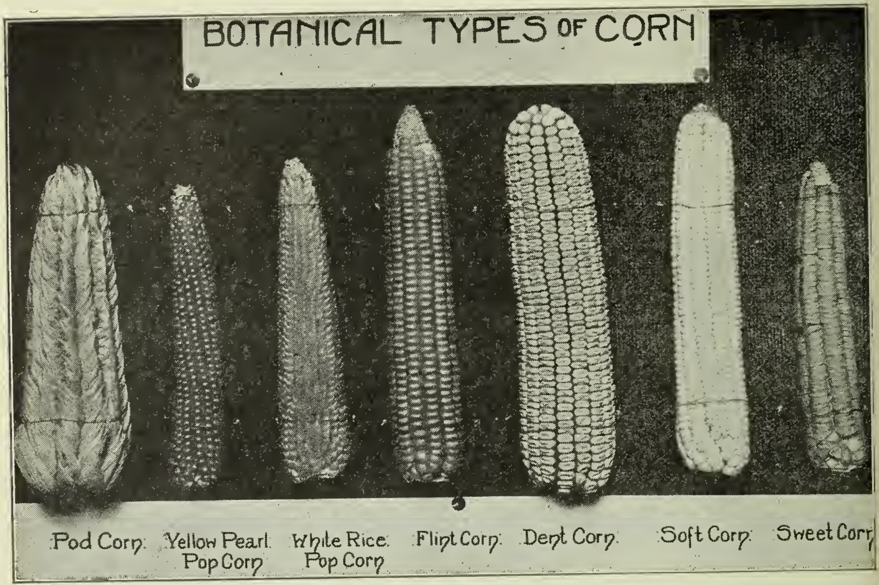


The purpose of this circular for members of grain and soil judging clubs is (1) to teach them to recognize the types and varieties of corn, wheat and oats; (2) to familiarize them with the score card used for each of these grains; and (3) to furnish a brief history and description of some of the most common varieties. Every farm boy should have this information. It is important and worth while to be able to go into a field and pick out and name the variety of grain grown and to select the ideal type either for seed or exhibition. It is important to know the facts concerning the producing qualities of important varieties when grown in certain soils in different sections of the state.

VARIETIES OF CORN

There are six types of corn, from which many varieties have been developed. Learn the names of the types of corn.

The most important of these types is the dent corn of which a great many varieties have been developed. It is estimated that nine out of every ten ears of corn grown in the United States or this state are of the dent type. This type requires a long growing season but yields much heavier than any other.

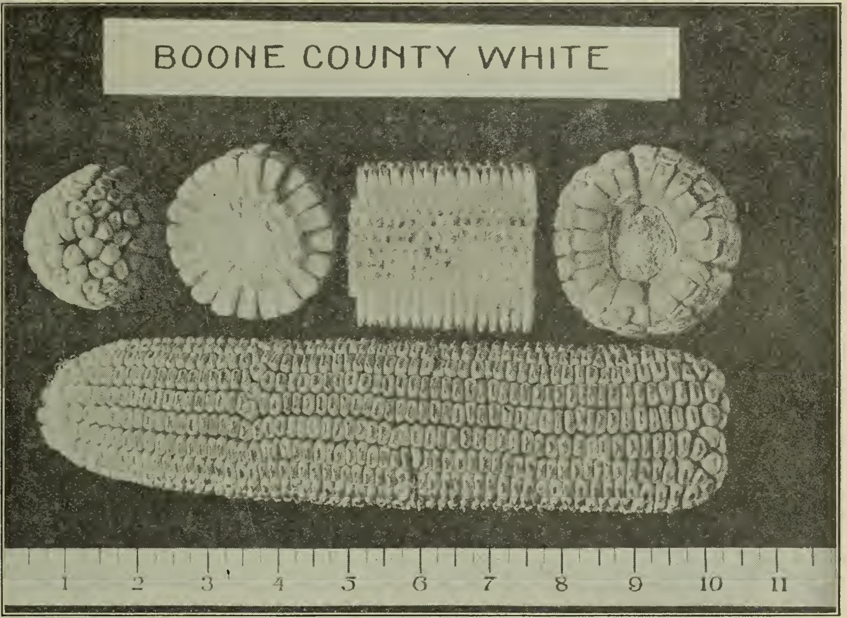


The leading varieties of dent corn grown in Missouri are Boone County White, Johnson County White, St. Charles County White, Silvermine, Reid's Yellow Dent, Leaming, and Cartner. Descriptions of three of these varieties follow:

BOONE COUNTY WHITE

History.—The Boone County White corn was originated by James Riley of Boone County, Indiana. He began work in 1876, using as a basis a large, coarse, late-maturing variety of corn known as White Mastodon. The selections from the White Mastodon corn were planted in a separate field and from that time on were never allowed to mix with other varieties of corn. Mr. Riley selected a smaller, earlier maturing ear than was prevalent in the White Mastodon and as a result of persistent work he secured earlier maturity, deepened the grain, and increased the proportion of corn to cob. The new variety was named for the originator's home county, Boone County.

About three years after Mr. Riley distributed the Boone County White corn among the farmers, O. C. Block began breeding it. He is perhaps the best known breeder of this corn after its originator. Block deepened the kernel materially, increased the roughness, and also the circumference in proportion to the length.



This variety of corn is one of the most prominent in Missouri. It is grown very largely along the Missouri and Mississippi river bottoms and the better uplands of the state.

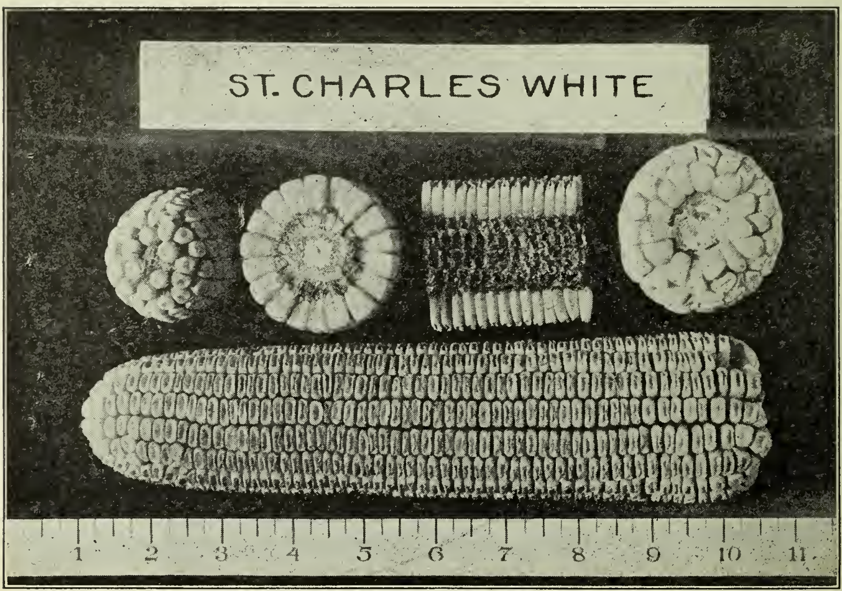
Characteristics.—The standard of Boone County White is, ears 10½ to 11 inches long and 7½ to 8 inches in circumference. The ears should be nearly cylindrical, with an average of 16 to 20 straight rows of kernels. The cob is rather large; the kernels medium to wide, rather thick and of medium depth. The germ is generally large and bright. The indentation varies, as a result of the work of different breeders, from a smooth dimple to a short beak.

Boone County White is a medium late maturing variety requiring from 120 to 125 days for complete ripening. The stalks are strong and thick and grow in Missouri to an average height of about 8½ feet. They are leafy and make good silage and fodder.

The corn matures well in the field, with a very high percentage of marketable ears.

ST. CHARLES COUNTY WHITE

The St. Charles County White is a native of Missouri, having been developed in St. Charles County where it has been grown for a great many years. It is one of the most popular varieties in the southern half of the state and hundreds of bushels are shipped to the Southern States each year, where it is widely grown. Much seed is shipped East and North where this variety is grown and used as a silage corn.



There are two types of the St. Charles, the small and the large. The small is slightly earlier and better adapted to thin lands. The St. Charles County White is hardy and has wide adaptations. It is a valuable variety for South Missouri conditions; the small type on uplands, and the large type on the bottoms.

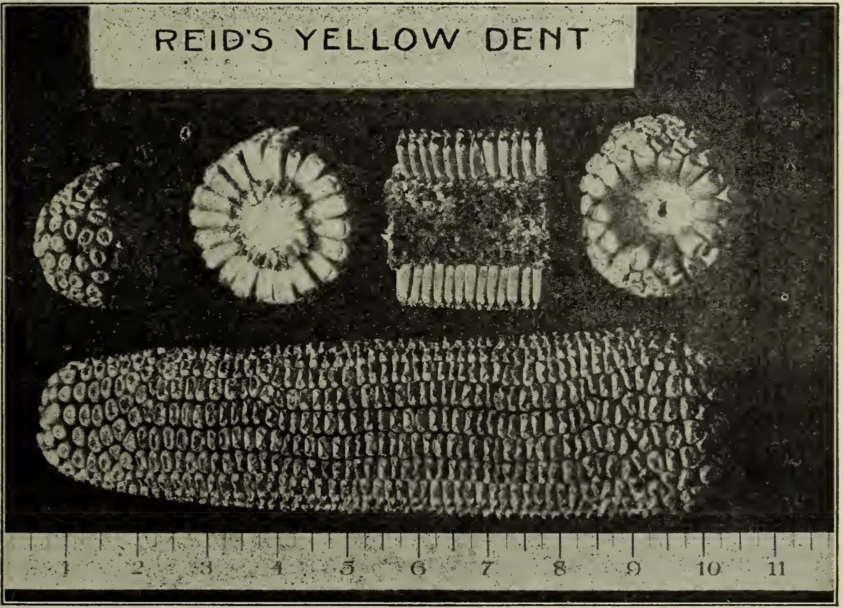
Characteristics.—The ears taper somewhat from butt to tip, with rows straight and slightly paired. The butts are moderately rounded, and the tips tend to be well covered with fairly deep kernels. The cobs differ from other white varieties by being bright red in color.

The standard ear is 9½ to 10 inches in length and 7¼ to 7½ inches in circumference. The kernels are of medium breadth and of good depth. They are, however, only slightly wedge-shaped, therefore, not closely spaced at the top. They show a large percentage of horny starch, medium to large germs, and are deep to crumple creased in indentation. The kernels are pearly white in color.

St. Charles County White is a late maturing variety averaging 125 to 130 days for complete maturity. The stalks make a rank growth and are somewhat taller than Boone County White. The stalks range from 8½ to 9½ feet in height. The leaves are broader than those of the Boone County White. The St. Charles is an excellent silage corn.

REID'S YELLOW DENT

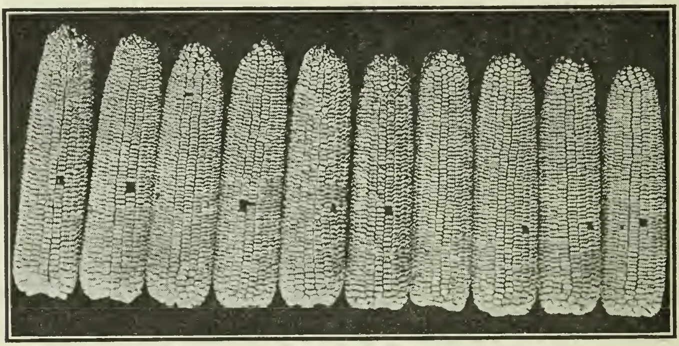
History.—In 1846, Robert Reid brought from Brown County, Ohio, to Illinois, a variety of corn known as the Gordon Hopkins Corn. It is a reddish colored corn, grown widely in the vicinity of Red Oak settlement, the home of Robert Reid. Seed was selected from this crop for the next year's planting. On account of its immaturity a poor stand was the result, so the missing hills were replanted with seed of a small yellow corn. The cross with yellow corn was purely accidental. The result was the beginning of the Reid's Yellow Dent we know today.



James L. Reid, son of Robert Reid, was the first to recognize the real merits of the new corn and at once began to improve it by selection. Since 1847 the corn has not been crossed by Mr. Reid. Fifty years of continued careful selection has firmly fixed the characteristics of this corn.

Characteristics.—The standard for Reid's Yellow Dent is ears 10 to 10½ inches long and 7¼ to 7½ inches in circumference. The rows or kernels should be straight and the most closely spaced of any variety. The cob is rather small and dark red in color. The kernels are narrow to medium in width, slightly wedged, and a lemon yellow in color. The germs are often small, while the indentation ranges from a creased dimple to a crumpled crease, as a result of the work of different breeders.

Reid's Yellow Dent is a medium early maturing variety requiring 115 to 120 days for complete ripening. It averages about eight feet in height and is only medium leafy. It has a decided tendency to mature soundly and is best adapted to land above medium fertility.



A prize-winning sample

JUDGING CORN

At fairs and other places where corn is shown for premiums, ten ears usually constitute the sample for exhibition. In judging, the ten ears must be considered as a whole. Each ear should match each other ear as nearly as possible; in other words, ears selected for exhibition or for seed should be uniform in size, shape, color, length and indentation; have good germs, straight rows, good butts and tips and medium sized cobs.

The object of the work in this club is to teach members to judge and score grains; corn, wheat and oats. The score card will aid members to fix in mind the important things which make up a standard sample.

In spelling ten words, ten points are taken off for each mispelled word. Similarly, in scoring a sample of corn, so many points are taken off for each imperfection. For example, on the score card, 15 points is given "character of germs" for perfect. Cut or take off from ¼ to 1½ points for each ear having poor germs. Ten points is given "length of ears" for perfect. Cut according to how much the sample is greater or less than the length named as standard. Five points is given for perfect tips. Cut from ¼ to ½ point for each defective tip. Do the same for the butts and size of cob. When you have scored a sample of ten ears (taken as a whole) add the points and find the total.

Score at least ten samples of corn. Much practice with the score card will teach members to recognize the perfections and imperfections in a sample of corn.

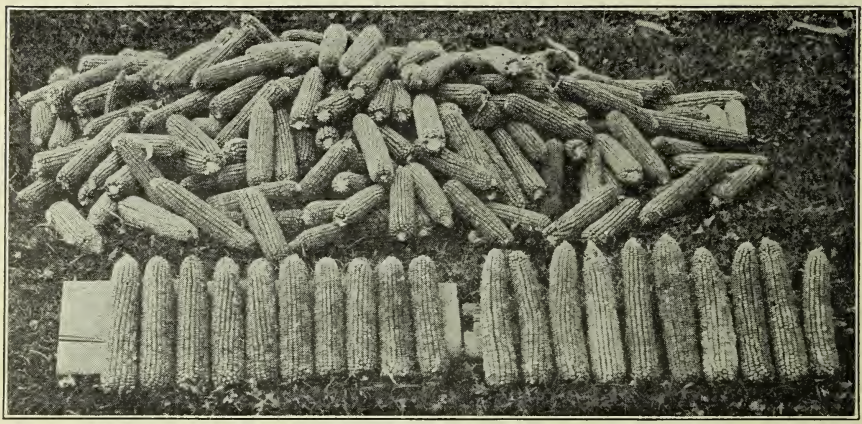
The same general procedure is followed with the score card for wheat and oats.

CORN SCORE CARD—TEN-EAR SAMPLE

Scale of Points		No. of Sample				
		1	2	3	4	5
Trueness to type and breed characteristics—						
1. Uniformity of type	10					
2. Shape of ears	5					
3. Length of ears	10					
4. Circumference of ears	5					
5. Purity of kernel	5					
6. Purity of cob	5					
	40					
Maturity and market condition—						
7. Maturity	10					
8. Market condition	5					
	15					
Yielding qualities and vitality—						
9. Character of germs	15					
10. Shape of kernels	10					
11. Uniformity of kernels	5					
12. Butts	5					
13. Tips	5					
14. Size of cob	5					
	45					
Total	100					

VARIETY STANDARDS

	Length	Circumference
Yellow		
Reid's Yellow Dent	10 to 10½	7¼ to 7½
Leaming	10 to 10½	7½ to 7¾
St. Charles Yellow	10½ to 11	7¼ to 7¾
Cartner	9 to 9½	7¼ to 7½
White		
Boone County White	10½ to 11	7½ to 7¾
St. Charles White	10 to 10½	7¼ to 7½
Johnson County White	10½ to 11	7½ to 7¾
Silvermine	9 to 9½	7 to 7¼
Commercial White	10½ to 11	7½ to 7¾
General Entries	9½ to 10½	7¼ to 7¾



Select uniform ears for the sample

SUGGESTIONS FOR SOMETHING TO DO

Select ten ears of corn of the same variety. These should be as nearly uniform in size, shape, color, length and market condition as possible. Take these ears to the Club meeting. Compare with ears brought by other members. How many members of your Club raise Boone County White? St. Charles County White? Reid's Yellow Dent?

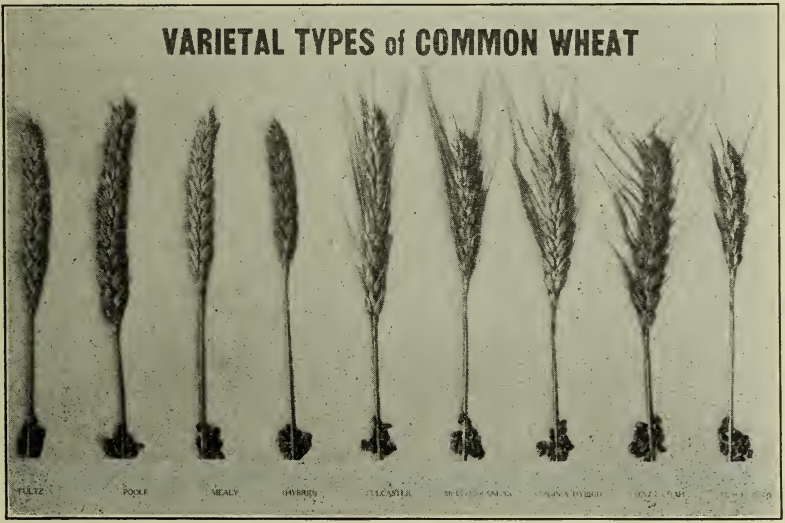
Find some ears of corn having as good butts and tips as those in the picture. Pick out as many ears from your sample as you can which have proper size, shape, length and indentation. Does the surface of your ears look like that in the picture? Are the rows straight? Are the tips well filled? Are the grains of the proper size and shape? Are there any mixed grains on the ears?

Study carefully the score card for corn and when you understand it, score the ten-ear sample.

Place four ten-ear samples on a table or board and number them, 1, 2, 3, 4. Select the best sample and write the reasons why you think it is the best. Select the second best, the third best, and write your reasons for the selections.

VARIETIES OF WHEAT

The varieties of common wheat in this country are divided into two general groups, winter wheat and spring wheat, depending upon whether the crop is seeded in the fall or in the spring. With the exception of a small acreage of spring wheat grown in North Missouri, the wheat crop of this state is made up of the group called winter wheat. Spring wheat is grown in the North where a fall sown crop does not withstand the extremely cold winters. There are many varieties of winter wheat but the most important ones in Missouri are the following:



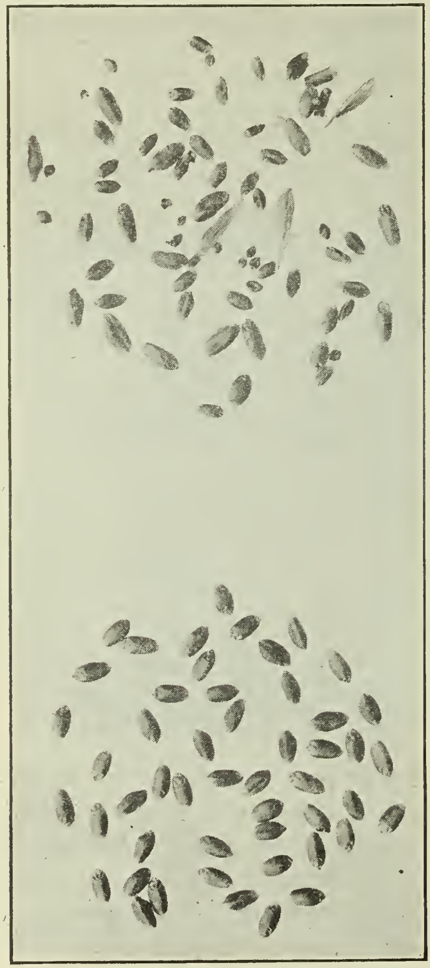
Poole.—A variety of soft winter wheat with red kernels, beardless heads, and red or brownish hulls. (Second, in the illustration.)

Fulcaster.—A variety of soft winter wheat which is often classed as semi-hard. It has hard red kernels, white chaff, and bearded heads. (Fifth, in the illustration.)

Mediterranean.—A variety of soft winter wheat with red kernels, red or brownish chaff, and bearded heads. (Sixth, in the illustration.)

Fultz.—A variety of soft winter wheat with red kernels, white chaff, and beardless heads. (First, in the illustration.)

Turkey.—A variety of hard winter wheat with very hard red kernels, white or yellow chaff, and bearded heads. The Turkey succeeds well in Missouri only in seasons preceded by extremely hard winters. It is therefore better adapted to North Missouri than to other parts of the state. In average seasons the varieties of soft or semi-hard wheat will outyield the Turkey.



Two samples of wheat. Above, a low-grade sample; below, a high-grade sample.

JUDGING WHEAT

In this club work a sample of wheat consists of at least one-half pint. Take a handful of grain as it comes from the sample and spread or scatter it on a board or table. With a knife blade count out 100 grains just as they come, including, but not counting, every particle of foreign matter, broken grains or other seeds. The score is to be made from this sample of 100 grains and foreign matter. Three such samples from the same bin should be taken and scored, the average of the three to be the final score.

SCORE CARD FOR WHEAT

Scale of points		Sample Number					
		1	2	3	4	5	6
1. Foreign matter, conforming to standard	10						
2. Color and purity	15						
3. Size and shape	15						
4. Plumpness	10						
5. Hardness	15						
6. Soundness	20						
7. Weight per Bushel	15						
Total	100						

1. *Foreign matter* (10): Cut 1 point for each weed seed found in the sample and ½ point for each particle of other foreign matter.

2. *Color and purity* (15): Cut 1 point for each grain in the sample that is distinctly "off color" from the average.

3. *Size and shape* (15): Cut 1 point for every grain decidedly different in size and shape from the average.

4. *Plumpness* (10): Cut ½ point for each grain that is shriveled or of poor shape.

5. *Hardness* (15): For each kernel showing a distinctly white cross-section, cut 1 point.

6. *Soundness* (20): Cut 1 point for every grain showing unsoundness.

7. *Weight per bushel* (15): A gallon of wheat should weigh 7½ pounds. Cut 4 points for every ¼ pound less than 7½ pounds. Add 1 point for every ¼ pound more than 7½ pounds.

SUGGESTIONS FOR SOMETHING TO DO

Collect a small sample of wheat, at least two hundred grains. Of what variety is the sample? What percentage of the grains are perfect? What percentage of the grains are damaged? Score the sample according to directions. How much does it score?

Explain the difference between Poole and Fulcaster. Between Fultz and Turkey. Which variety is best suited to Missouri soils and climate?

Collect samples of as many different varieties of wheat as you can find in your district. Put each sample in a bottle and label it.

Score at least five samples of wheat according to the directions on the score card.

JUDGING OATS

A good sample of oats must be pure, must be free from foreign matter such as dirt, sticks, and chaff; must be sweet, not musty or dusty; and must be seed that will germinate.

The score card trains one to observe the points that make up a good sample of oats. The same method of procedure is to be used as in the case of corn and wheat.

SCORE CARD FOR OATS

Scale of Points		Sample Number					
		1	2	3	4	5	6
1. Foreign matter	15						
2. Color	10						
3. Uniformity, length and shape	10						
4. Quality, size and plumpness	20						
5. Damaged grain	15						
6. Weight per bushel	30						
Total	100						

1. *Foreign matter* (15): Cut 2 points for every weed seed and 1 point for each particle of other foreign matter present.

2. *Length and shape* (10): Cut 1 point for every three grains differing greatly from the average.

3. *Color* (10): Cut 1 point for every two grains found off color.

4. *Size and plumpness* (20): Cut 1 point for every two grains found to be empty hulls, shrunken or light kernels.

5. *Damaged grains* (15) Cut 1 point for every damaged grain found in your sample.

6. *Weight per bushel* (30): A gallon of oats should weigh 4 pounds. Cut 4 points for every ¼ pound less than 4 pounds.

SUGGESTIONS FOR SOMETHING TO DO

Collect a sample of at least one pint of oats. Are they red or white? What percentage of the grains are damaged? Score the sample according to the score card. What is the score?

Each member of the club should collect as many different varieties of oats as are found in the district. Place each sample in a bottle and label it.

Score at least five samples of oats according to directions.

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AGRICULTURAL EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 59 COLUMBIA, MISSOURI DECEMBER, 1918

(Reprinted October, 1919)

Winter Eggs for Missouri

T. S. Townsley

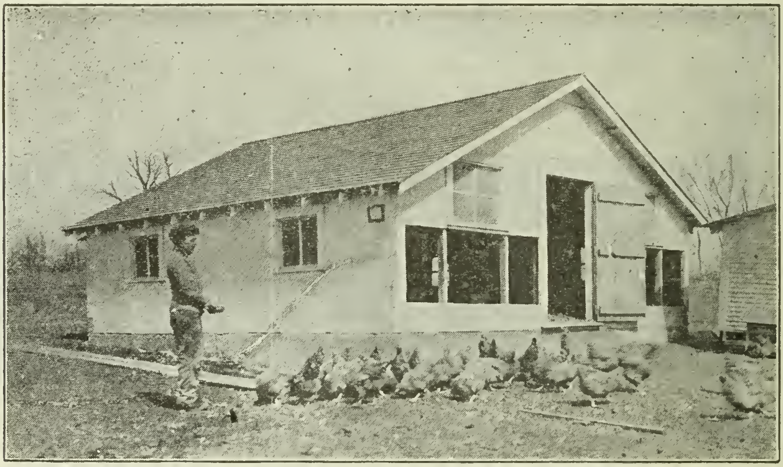
Early hatched pullets lay in winter

The poultry flock which is expected to lay winter eggs must have laying ability, be housed in comfortable quarters, and be fed a ration which furnishes the proper materials for the manufacture of eggs.

The ability to lay is most pronounced in vigorous, well developed pullets and for this reason every farm flock should contain a large percentage of early hatched pullets. A hen's laying ability decreases rapidly with age. No hen should be kept past the profitable period. With Plymouth Rocks, Rhode Island Reds, Wyandottes, Orpingtons and the heavier breeds, one should dispose of all two-year-old hens, while with Leghorns and the lighter breeds, the best hens may produce satisfactorily up to three years of age. To lay well in winter, pullets must be hatched early and fed liberally thruout the summer so that they are mature by November first. March and April are the most suitable hatching months in Missouri, and pullets hatched later than May cannot be expected to produce winter eggs. The tendency to lay heavily is an inherited character and can be bred into a flock of any variety. To fix the winter laying tendency, only winter laying females should be used in the breeding pen and the male should be the son of a hen that laid heavily in cold weather.

FLOCKS MUST BE HOUSED COMFORTABLY

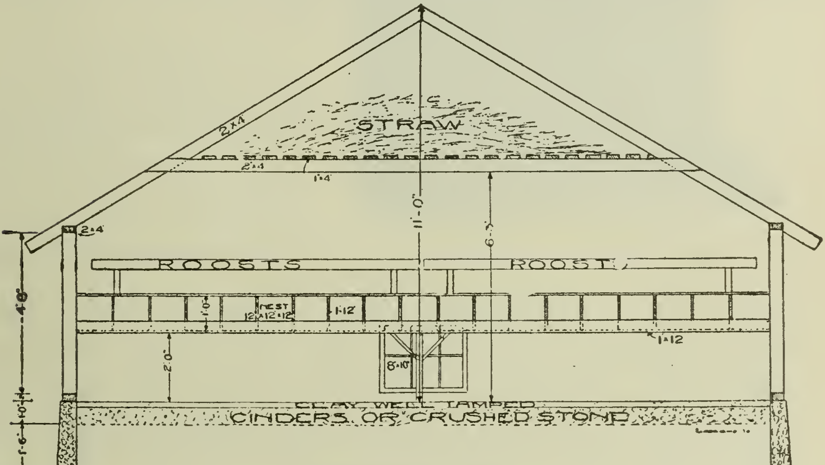
Comfortable quarters should be furnished the pullets as soon as they are ready to start laying. The poultry house is both the home of the hen and the factory where winter eggs are produced. Unless it provides suitable living and working conditions the hen cannot accomplish satisfactory results. Comfort is the important essential to a poultry house. To provide comfort the house must be dry, well lighted, and well ventilated and have sufficient floor space to furnish exercise by scratching. It must also contain sleeping quarters that are clean, well ventilated and yet free from drafts. All these conditions can be met in one room, thus economizing in the expense of building. Ventilation in a poultry house is secured by leaving the south side relatively open and making the other sides tight. This provides plenty of fresh air without drafts. Where possible, light should be admitted from all sides. This prevents dark corners and eliminates the nuisance of having the litter all scratched to one side, which occurs when light is secured from only one direction. Exercise is insured by keeping the floor covered with several inches of straw, and feeding all grain in this litter. The roosting quarters should be compact and comfortable. They can be made easy to clean by placing all roosts on a level at the north side of the house and by arranging a platform underneath the roosts to catch the night droppings. All these requirements are admirably provided in the Missouri Poultry House, and persons expecting to build should consider the plans of this house.



The Missouri Poultry House

THE IDEAL FARM POULTRY HOUSE

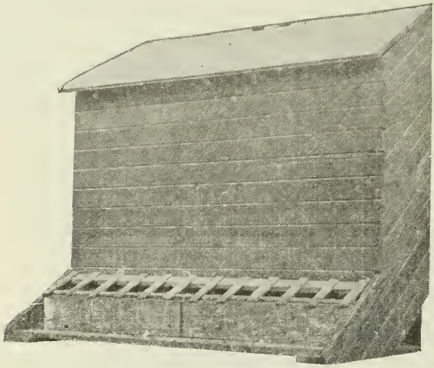
The Missouri Poultry House was designed by the poultry department of the University of Missouri to furnish a satisfactory plan of poultry house for the average Missouri farm flock. It has been built on many farms in the state and always gives excellent results. This house is twenty feet square and will accommodate as many as 150 hens. It has a gable roof of sufficient pitch to allow the use of shingles for roofing. The walls are five feet high at the eaves, and eleven feet high at the peak. Ventilation is secured by means of a thirty-inch wide opening on the south end, extending to the walls on each side of the door. For light, seven windows, each two feet high and three feet wide are used. These are placed two in the south, two in the east, two in the west and one in the north end. This provides sunshine in the house at any hour the sun is shining and eliminates dark corners. The roosts are placed level against the north end; 14 inches from the wall, 12 inches apart, and made of 2x4's with rounded corners. Eight inches beneath the roosts is placed a droppings platform which catches the manure and keeps the floor clean. Underneath the droppings platform are placed the nests. The excess space in the gable is made into a loft which is filled with straw. The straw keeps the house dry and warm in winter and cool in summer. Complete plans of this house are found in Circular 80 and can be secured by writing to the University of Missouri, College of Agriculture, Columbia, Mo.



Sectional View

THIS RATION MAKES WINTER EGGS

The following ration for winter egg production satisfies the needs of the hens and as a war time ration is economical and practical for most sections of Missouri. During the past year it has been fed on a number of Missouri farms with good results.



Self-feeder for dry mash

DAILY RATIONS FOR HENS

	Scratch Grain
10 pounds	shelled corn
5 pounds	dry threshed oats
	Dry Mash
3 pounds	wheat bran
3 pounds	wheat shorts
1½ pounds	commercial meat scrap

Where milk is plentiful three gallons of skimmed milk or buttermilk furnished each one hundred hens daily will take the place of meat scrap. Either milk or some form of lean meat must be supplied in every ration for successful winter egg production. Commercial meat scrap can be obtained from most feed dealers in one-hundred-pound sacks. One sack will supply protein needed by one hundred hens for more than two months. Kaffir or feterita may be substituted for the corn. Barley or feed wheat may be used instead of oats. Corn meal or ground oats may be substituted for shorts in the mash. Alfalfa meal or clover leaves may take the place of the bran. A good grade of tankage may be used instead of the meat scrap. In feeding this ration all grain should be fed in deep straw to compel the birds to exercise. The mash should be fed in self-feeding hoppers or troughs and a supply kept before the birds. In addition to this ration, hens should have an abundance of water, a supply of green food and free access to sharp grit and crushed oyster shells, or soft limestone grit. With early hatched pullets, housed comfortably, and fed this ration, winter eggs are assured.

Note—Acknowledgment is hereby made of the valuable assistance given in the preparation of this circular, by Prof. H. L. Kempster, Mr. R. L. Mason and Mr. H. E. Cosby.

Distributed in furtherance of the Smith-Lever Act approved May 8, 1914, by the University of Missouri College of Agriculture, Agricultural Extension Service, A. J. Meyer, Director.

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AGRICULTURAL
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CIRCULAR 60 COLUMBIA, MISSOURI DECEMBER, 1918

Handling the Alfalfa Crop

J. C. Hackleman

Question.—Is alfalfa adapted to our conditions, and is the crop valuable for the Missouri farmer? Answer.—Alfalfa, according to the 1910 census, was found in every county in Missouri. This does not indicate that it will grow on every farm. Some counties have less than one hundred acres of alfalfa. Recent estimates by the Missouri Co-operative Crop Reporting Service indicate that the alfalfa acreage has increased 54 per cent since 1910.

Alfalfa is best adapted to well-drained, rich, bottom lands. It can be successfully grown on black prairie lands and on the better rolling timber lands but more attention must be given the crop both before and after seeding.

Q.—How should the seed bed be prepared, and what crops should alfalfa follow? A.—Next to having clean seed that will grow, perhaps the most important consideration is the seed bed. No amount of work, time, and energy after seeding will ever make up for a failure to have a good seed bed at the time of seeding. Most farmers prefer to seed alfalfa in August, therefore breaking is most commonly done in the early summer. Plow just as early as possible, preferably in June, certainly not later than early July, and work the land down to a fine seed bed without delay. The best way is to harrow down each day's breaking before leaving the field. This mellow surface seed bed should be maintained during the summer by harrowing at ten-day or two-week intervals.

The seed bed for spring seeded alfalfa can probably best be prepared by fall breaking and then disking and harrowing. In case the land is not weedy and the previous crop, probably soybeans or corn, was removed without leaving much refuse in the field, the breaking may be omitted. A double disking and thoro harrowing early in the spring may suffice for the seed bed preparation.

The best crop to precede alfalfa will depend somewhat upon the time of seeding and also the type of land. Where late summer or fall seeding is practiced an early maturing crop such as oats or spring barley is perhaps best provided, and the crop is cut for hay. Alfalfa can be satisfactorily seeded after a wheat crop if the crop is threshed early, or stacked. Early potatoes also are a satisfactory crop to precede alfalfa and usually this land can be prepared without breaking, simply disking thoroly, and harrowing frequently.

Q.—Should manure, commercial fertilizer, or both be used on alfalfa? A.—Manure by all means should be used on lands of medium to low fertility. If used ahead of alfalfa much future trouble can be obviated by spreading manure which is free from weed seeds. Manure from cattle fed on silage will contain much less grass and weed seed than manure from horses fed on weedy timothy and bluegrass hay.

Missouri soils in general respond readily to phosphates. In those parts of the state where alfalfa is especially adapted, a phosphatic fertilizer is perhaps more important than manure, since those soils are usually well supplied with organic matter. The bone meals, preferably steamed bone, is one of the best phosphatic fertilizers for alfalfa but at present it is practically impossible to get. The next best phosphatic fertilizer is acid phosphate, used at the rate of two hundred to three hundred pounds per acre.

Alfalfa production on poor and worn lands can be stimulated by the use of five to eight tons of good barnyard manure and two hundred to three hundred pounds of acid phosphate. It is not good practice to seed alfalfa on poor and worn out soils because on such land it will never give as profitable crops as are expected.

Q.—Will liming the soil help? A.—Alfalfa needs considerable lime, but fortunately in those sections where alfalfa is otherwise well adapted the soil is fairly well supplied with lime. On the more worn soils and on acid soils an application may be needed. An acid soil is frequently caused by poor drainage resulting from level land and "tight" subsoil. These conditions, which are very detrimental to alfalfa production, cannot be corrected economically with lime.

A.—In what form should lime be used? A.—The kind of lime most commonly used is ground limestone rock, which can be got from many of the rock crushing companies in the state. Air- and water-slaked lime also are used but much less generally. The ground rock is more economical and just as good if applied in proper quantities. Applications will vary with the soil requirements, from two thousand to six thousand pounds an acre. The College of Agriculture sends instructions regarding soil sampling and will make lime requirement tests without charge.

Q.—Is inoculation essential? How do you inoculate? A.—A field which has recently grown sweet clover, or a piece of bottom land which has been catching the run-off from a hillside covered with sweet clover or alfalfa, may not need inoculation. Under most conditions inoculation is essential.

Where soil culture is used, sifted soil from the upper four to six inches of an alfalfa or sweet-clover field may be scattered at the rate of 250 pounds per acre over the land to be seeded. Smaller soil cultures may be used by sifting from five to seven pounds of inoculated soil over one bushel of seed previously moistened with five per cent solution of syrup (black-strap or sorghum is good). The commercial cultures are always accompanied by directions.

Q.—What is the proper date of seeding? How should the seeding be done A.—Alfalfa is seeded in Missouri both in the early spring and in the late summer or fall. Best results seem to come from August or early September seeding. This is particularly true on land not ideally adapted to the crop and on fields likely to become weedy. In regions and on lands where alfalfa is best adapted some farmers practice seeding with wheat in February or March, just as clover is seeded.

Care should be taken that the alfalfa seed be covered as sown or very soon afterward. On all prepared seed beds the best stands may be expected by seeding with a drill. If no drill is available harrow the seed in with a light drag harrow or with some brush.

Q.—Are there different varieties or strains of alfalfa, and, if so, which ones are best? A.—Results indicate a distinct difference in the habit of growth and hardiness of the different varieties and strains. In general, alfalfa seed grown in the North and Northwest seems more hardy under Missouri conditions, particularly if the strain has been grown for several years under the relatively severe conditions of the North.

Q.—Why does alfalfa winter-kill so badly in Missouri? A.—Winter-killing may be due to any one or all of several troubles; wet soil, acid soil, tight clay soil, lack of inoculation, poor seed, or a variety or strain not adapted. Wet soil frequently is acid. Alfalfa on acid soils, or planted without inoculation, or from poor seed, may produce unthrifty plants which are too weak to withstand the severe winter. Tight soils do not permit of deep rooting and, therefore, the plants "heave out" readily during the alternate freezing and thawing. Plants from southern seed will likely suffer more from winter-killing than those from northern seed.

Q.—Should alfalfa be cultivated; if so, how? *A.*—Where the stand of alfalfa is threatened by weeds and weed grasses, cultivation, if properly done, may save the crop for two or three years, or it may be so well done as to stop entirely the growth of these weeds. Various methods and implements for the purpose have been tried out. The most satisfactory implements are those harrows having spring teeth with a very small blade. Some farmers use the spring-tooth harrow to good advantage by setting it to "scratch" rather lightly. The disk harrow and the spring-tooth harrow when set to "scratch" deeply are sure to cause injury to the plants. Where the crown is split or the plant is otherwise injured so that some fungous disease gets under the skin near the crown, it will likely mean an early death to the plant.

Q.—What quality of seed is found available in Missouri? *A.*—Because we have no law which compels the analysis and proper labeling of farm seeds, much inferior seed not saleable in states having seed laws finds its way to Missouri farms. This seed is usually bought by the farmer who wants $10 alfalfa seed when good seed is worth $15.

A seed testing laboratory is maintained at the College of Agriculture. Any farmer who will send in a sample of seed (three or four tablespoonfuls) will receive a report on that sample in a few days, stating not only the percentage of purity but naming all weed and foreign seeds found.

Q.—How often should alfalfa be cut? How do you tell when it is ready to cut? *A.*—Some seasons, under favorable conditions, four or five cuttings may be made. The same field under the climatic conditions of another year might not produce more than two good cuttings, with possibly a light third. The surest way to tell whether or not alfalfa is ready to cut is to examine the young branches or shoots which always come out just at the base of the tall stems around the crown of the plant. These young branches should be from one-half to two inches long when the crop is cut.

Q.—What is the best method of handling alfalfa hay? *A.*—Perhaps the best method for curing the hay is to cut it in the forenoon after the dew is off and rake it in windrows after it wilts somewhat, letting it lie over night. As soon as the dew is off the next day these windrows can be turned over with the rake. After the under side has been allowed to dry somewhat the hay can be put into small cocks. These cocks will turn water fairly well altho they are best if covered with a cloth cap. After the hay goes thru a sweat, usually requiring two days, it will be ready for the mow.

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CIRCULAR 61 COLUMBIA, MISSOURI DECEMBER, 1918

Liming for Clover

B. W. Tillman

Question.—Why is liming so commonly recommended in connection with clover growing? *Answer.*—Clover absolutely fails if soil is very acid, and this condition must be remedied by liming. Roughly estimated, at least one-half of the cultivated soils on Missouri farms are sour or acid, much of it too acid for successful clover growing.

Q.—Is clover the crop most benefited by lime? *A.*—No. Alfalfa and sweet clover are benefited by liming more than clover. However, since clover is much more extensively grown than these other legumes, the use of lime on clover is of much greater economic importance in Missouri.

Q.—What lands in Missouri need liming for clover? *A.*—In general, lime is commonly needed on the level prairies of northeast Missouri, including the types of soil known as the Putnam silt loam and Grundy silt loam; a large part of the rolling prairie lands in north-central Missouri, known as the Shelby loam and the Lindley loam; the prairie lands of west-central Missouri located mainly in Cooper, Moniteau, Morgan, Pettis, Johnson, Henry, Bates, Vernon, and Barton counties and including types of soil known as the Oswego silt loam, the Cherokee silt loam and the Bates silt loam; considerable areas of land in the Ozark and border Ozark region, particularly the Lebanon silt loam and parts of the Crawford, Union and Tilsit silt loams.

Q.—How can one tell when land needs lime for growing clover? *A.*—By testing the soil for acidity. Probably the most commonly used test for soil acidity is the litmus paper test. It is a reliable method in the hands of an experienced man. Take a moist ball of the field soil, break it open, insert a strip of blue litmus paper and press the soil together. If the paper turns an even and distinct pink color within about five minutes, the soil is acid. However, this test does not show how much lime is needed to correct the acidity. A simple chemical test known as the Truog test, has come into use recently to indicate the amount of lime needed to sweeten the soil. The Soils Department of the Missouri College of Agriculture is equipped to make this test free for farmers of this state provided the soil samples are taken according to directions which are sent on request.

Q.—Is the appearance of sorrel a sure sign of lime need? A.—No. A heavy growth of sorrel to the exclusion of grass and clover might be considered a reliable indication of need of lime, but a few scattering plants can not be so regarded.

Q.—Are all clover failures due to the need of lime in the soil? A.—No. Probably not more than one third of the clover failures are directly due to the need of lime in the soil altho a low lime supply may often be partly responsible for the failure to secure a clover stand.

Q.—Is clover sufficiently important to warrant the expense of liming? A.—Yes. Clover bears a closer relation to the problem of permanent soil enrichment in Missouri than any other one crop. By growing a good crop of clover once in three or four years, the farmer becomes independent of the fertilizer industry for his supply of nitrogen, which at present prices is costing forty cents a pound. If he feeds the crop to his animals and conserves the manure he maintains his soil in the most economical manner. A ton of clover returned to the soil supplies about 40 pounds of nitrogen to the soil in the most readily obtainable form for plants. On the other hand, the nitrogen added to the soil in an acre application of 150 pounds of an ordinary 2-10-2 fertilizer amounts to only 3 pounds per acre, and a 75-bushel corn crop will remove in the grain alone 75 pounds of nitrogen. There is, therefore, no surer way to soil depletion and ultimate bankruptcy than to neglect the supplying of nitrogen thru clover or other legumes.

Q.—What are the different forms of agricultural lime which may be used for clover? A.—The different lime compounds which may be used for agricultural purposes are burned, or lump lime, hydrated or water-slaked lime, and ground limestone.

Q.—What kind of lime should be applied and how much? A.—The kind of lime to use depends entirely on the kind which has the greatest "sweetening" power per dollar invested. In determining this, one must remember that one ton of ground limestone is required to equal 1100 pounds of lump lime, or 1500 pounds of water-slaked lime where all are made from a high-grade stone. In most localities, excluding those within wagon haul of a lime kiln, ground limestone will be the cheapest form to use. Of course, ground limestone is more bulky, but the difference in freight rates and cost of handling because of this fact, is small compared with the difference in first cost.

The amount of lime to use depends entirely on the degree of soil acidity. No fixed amount of lime can be prescribed without this information. The thing to do, therefore, is to have the soil tested for its lime need, and apply the limestone accordingly. In general, 1½ to 2 tons once in six or seven years would be a reasonable rate where clover fails or lacks thrift. Some soils, however, require considerably more than this.

Q.—How fine should limestone be ground? *A.*—Experiments which have been made in comparing limestone pulverized to different degrees of fineness show that it is the fine dust which gives the immediate results in sweetening the soil. There is, of course, some effect from the coarser material, but this is slow. All things considered, the best stone to use is one ground fine enough to pass thru a ten-mesh sieve; that is, a sieve with holes approximately one-tenth of an inch across or about like those of a fly screen. Such material will carry a large percentage of fine dust which will have an immediate effect in correcting the acidity. However, where coarser material can be obtained at a low cost, it may pay to use it, provided larger amounts are applied. In this way one obtains practically the same quantity of dust as is contained in the ten-mesh material. This question must be decided, therefore, upon the relative costs of the coarse and the fine material. It would rarely be wise to consider coarser material than that passing a four-mesh sieve.

Q.—When should lime be applied for clover and how soon are the benefits most apparent? *A.*—Limestone may be applied at any season, and anywhere in the rotation, but the application should be made after plowing and the material should be thoroly disked or harrowed in. Probably the best time to apply is before wheat in the fall so as to allow sufficient time for the proper reaction in the soil before sowing clover the following spring. One year is inadequate to determine the real value of liming because the greatest benefits are usually not apparent until the second and third season.

Q.—Does the fertility of the soil have any influence upon the need for lime? *A.*—Yes. Soils of high fertility usually grow good crops of clover without the use of lime. However, if the acidity is very strong, lime will be beneficial, or even necessary.

Q.—What does it cost to lime land? *A.*—Ground limestone costs now, applied to the land, from $2.50 to $3 a ton. The cost should be slightly less after the return to normal conditions following the war.

Q.—Is community grinding of limestone economical? *A.*—Yes, if the matter is properly handled. There are many localities in those regions where the soils are sour, located so far from the shipping point that the cost of hauling limestone to the farm prohibits its use; but in many of these cases native limestone is found which could be ground on the farm and used for sweetening the soil. Small portable crushers can be bought at prices ranging from six to twelve hundred dollars, which will grind from one to three tons of limestone an hour. The cost of grinding with these crushers will average from $1.25 to $2 a ton. In these communities, therefore, a number of farmers could club together to purchase a crusher and grind the limestone needed on their own farms.

Q.—What return can be expected? *A.*—One ton of ground limestone applied once in six years on the Missouri outlying soil experiment fields has brought an average increase of almost a half ton of clover an acre. During a four-year rotation of corn, oats, wheat and clover on these various fields the average value of crop increase from a ton of lime, at present prices of crops, has been about $8. It should be understood that the largest returns from this treatment are secured on those soils which are most acid, providing, of course, that enough lime is applied, approximately, to sweeten the soil.

For detailed information regarding the use of ground limestone for agricultural purposes write for Bulletin 146 of the Missouri Experiment Station, Columbia, Missouri.

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CIRCULAR 62 COLUMBIA, MISSOURI DECEMBER, 1918

Handling Barnyard Manure

F. L. Duley

Question.—What is a ton of manure worth? Answer.—Trials on the various soil experiment fields thruout the state have shown that an average application of eight tons of manure to the acre once in four years has increased the yield of corn 10.5 bushels, oats 5.17 bushels, wheat 5.24 bushels, and clover hay 937 pounds. At present prices this increase would be worth $4.83, and at pre-war prices $2.34, for each ton of manure applied. It will cost the farmer not more than one dollar a ton to collect the manure and haul it to the field. This would leave a net profit of $3.83 at present prices, or $1.34 at pre-war prices, for each ton of manure applied. The full value of the manure is usually not obtained during the first four years, for it leaves the soil in better condition and its effect upon later crops is often quite significant. This becomes more noticeable after the first two or three applications, since a liberal application of manure every four years will result in permanent improvement to the land.

Q.—How much manure can be produced from an acre of cultivated land? A.—By very careful handling of manure a live-stock farmer, on average soil, should be able to return annually, about two tons of manure per acre to his cultivated fields. It is not easy to save this amount except by very careful methods and persistent efforts. It is necessary that all straw and other suitable materials be worked thru the barns as bedding. This not only adds to the comfort of the animals, but serves as an absorbent for the liquid manure. If straw piles are sold, burned or left to rot it is, of course, impossible to return this amout of manure.

Q.—How can more manure be saved? A.—Keep the manure together; don't let it get scattered about the barn or lots. Hogs and chickens may waste much of it. Where possible haul it to the field as soon as produced. If this is not possible, store it in shallow concrete lined pits to prevent leaching. Use plenty of bedding in the stable or on the feeding floor to absorb the liquid. Straw, old hay, grass and leaves may be used for this purpose.

Q.—How much of the value of manure is to be found in the liquid portion? *A.*—About 35 per cent of the nitrogen and 55 per cent of the potassium is to be found in the liquid material. There is, however, practically no phosphorus in this part. The plant foods in the liquid are all in soluble form and are very easily lost thru leaching. Furthermore, the nitrogen in this liquid portion readily passes off as ammonia when the manure is allowed to ferment, hence the necessity for preventing fermentation as far as possible.

The total solid and liquid manure produced in a year by a well-fed, mature horse is about eight tons, with a plant-food value of more than $30. In the case of a well-fed steer weighing from 1000 to 1200 pounds the production is nine to eleven tons, with a slightly greater total value than the manure from a horse.

Q.—What influence has the age of the animal or the kind of feed upon the character of the manure? *A.*—Mature animals produce better manure than young stock, because the young animals retain much of the nitrogen and phosphorus in their tissues. Feeds rich in protein produce manure high in nitrogen content. Clover hay or cottonseed meal added to the ration will produce much better manure than a ration consisting of timothy, corn fodder and corn, or other low protein feeds.

The kind and amount of bedding also greatly affects the composition of manure. Oat straw used as bedding will produce manure with more available plant food than will material like coarse weeds or shavings.

Q.—Is it more economical of manure to feed on the land or around the barns? *A.*—From 10 to 40 per cent more of the fertility can be left on the land by pasturing crops or feeding in the field than by feeding around the barns. It has been found by experiment to be economical to produce pork and mutton by feeding grain in connection with the pasturing of forage crops, or by pasturing corn in the field. The manure from hogs and sheep is more often wasted than that from other classes of livestock, because it is more difficult to collect and haul back to the field. When crops are pastured the manure is left on the land with but very little loss of plant food. The soil fertility may also be made more uniform by establishing temporary feedyards on the thinner spots in the field. The largest losses of manure take place from the feed lots rather than from the fields.

Q.—Which is better, rotted or fresh manure? A.—Manure loses some of its plant food in the process of rotting, but its mechanical condition is improved and the plant food changed to a more readily available form. For truck crops where quick results are desirable and much manure is used, rotted manure is usually advisable, but for general farm practice there is too much loss in the rotting process. On the general farm, such losses should be avoided by getting the manure on the land as soon as possible.

Q.—What is the loss due to weathering? A.—Three to five months exposure to the weather in an open lot may cause manure to lose approximately one-third of its plant food. If manure must be exposed to the weather it should be in a pit with a water tight bottom.

Q.—What is the best way to store manure? A.—Manure fermentation is greatly lessened if it is kept compact and moist. When convenient, leave in sheds and allow stock to keep it compact by trampling. In such a case the liquid manure will keep it moist enough. If it must be removed to the lots, pile in ricks with nearly perpendicular sides and flat tops. If the rick can be made in a shallow concrete lined pit much of the loss due to leaching will be prevented. If properly ricked the rains will usually keep the manure moist enough to prevent most of the fermentation.

Manure carelessly piled or scattered in open lots is always subject to excessive leaching, as well as to fermentation. Furthermore, manure in loose piles often "fire-fangs." This condition is caused by molds and may result in a large loss of plant food in a very short time. Moist, well-packed manure does not "fire-fang."

Q.—What are the advantages of the manure spreader for handling manure? A.—The average man believes the saving in labor is the principal reason for using a spreader. Two others are equally important. The first is that manure applied evenly and thin gives more crop return per ton applied than manure scattered unevenly and at a heavy rate, common with hand scattering. Where much manure is to be applied this increased efficiency of the manure will soon pay for the spreader. The second reason for using a spreader is that it causes greater attention to the care and handling of manure. When a man has invested in a spreader it is pretty certain that there will be less waste of manure around the lots and barns.

Q.—With what crops should manure be used? A.—In Missouri manure is usually best applied to the land and plowed under before corn. Manure may also be applied profitably to other crops. Wheat responds very readily to moderate applications. The manure may be plowed under as for corn but it is much more commonly applied as a top dressing either at the time of seeding or during the winter. When the latter method is used it affords protection for the wheat during the winter and prevents much freezing out. It aids materially in obtaining a stand of clover or grass, sown with the wheat.

Manure also gives marked increases in the yield of clover or timothy hay. It is not usually applied directly to these crops in Missouri, however, but more commonly with corn or wheat and the residual effect secured upon the grass crop. Manure may also be applied to pasture land to aid in getting or holding a stand of grass. This can be done during the summer when there is no other convenient place to scatter the manure or during the spring when other land is soft.

Q.—Should a live-stock farmer use commercial fertilizer in addition to manure? A.—Yes, if his land is of ordinary fertility or if he wishes maximum crops. He should not use it, however, until he has taken care that every ton of manure also will be used. If the live-stock man who feeds a reasonable amount of legume crops takes proper care of the manure produced on his own farm, he will not need to spend so much money for commercial fertilizers. If his land is good he may get along without them for many years. To get the most from his manure, however, it is often advisable to use some phosphate with it in order to make it a better balanced fertilizer.

Q.—Does it pay to reinforce manure with phosphates? A.—Manure is low in phosphorus content, therefore it is good practice, even on fertile land, to apply 25 to 40 pounds of acid phosphate or raw rock phosphate with each ton of manure. This may be applied with the manure itself or put on with some small grain crop in the rotation. It is often best to apply the manure before corn and drill the acid phosphate with wheat. When rock phosphate is used it had best be put on with the manure. It might be said, however, that the results with rock phosphate have been less satisfactory in this state than results with more available phosphates. In either case it is well to be sure that the soil is sweet (liming it if necessary), for only under such conditions will the best results be obtained from either manure or phosphates.

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AGRICULTURAL EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 63 COLUMBIA, MISSOURI DECEMBER, 1918

Purebred Live Stock and the Average Farm

E. A. Trowbridge

Question.—What are purebred animals? Answer.—Purebred animals are those having sires and dams members of the same recognized breed. The guarantee that a buyer of purebred live stock has of its purity of blood is a certificate of registry with proper transfers of ownership for the animals in question.

Q.—How may one know that a certificate of registry is official? A.—An official certificate of registry should show the name of the secretary and the seal of the national association for the breed in question. A man who expects to buy purebred live stock should inform himself regarding the national association and its requirements for the breed he intends to buy and especially as to the name of its secretary. This may be had from the College of Agriculture, Columbia, Mo. In buying purebred animals, one should deal with men known to be honest and reputable. There can be dishonesty in the registration of live stock, but those who practice it are soon discovered and not permitted to register animals, or are otherwise forced out of business.

Q.—How did purebred live stock originate? A.—Long after the human race began to domesticate animals, some of the more enterprising breeders discovered differences in the ability of animals to produce the things desired, such as meat, milk, wool and work. They selected those which produced best and used them for breeding stock. People learned that the offspring of these "selected" animals produced more efficiently, but there was difficulty in keeping record of the offspring. Record associations were then formed to keep records of pedigrees and descriptions of animals and names of breeders and owners, thus helping to put the industry on a safe and businesslike basis.

Q.—What is the main purpose of purebred livestock at present; and how is it related to the production of market stock? *A.*—The main purpose of purebred live stock at present is for use as breeding stock in the improvement of individuals to be used for market production. Some of the less desirable purebred animals are sent to market thru the feed lot, and the best breeders always sell the inferior animals which are produced in this way. Purebred live stock is related to the production of market live stock by the fact that the most successful producers of market stock use males in their herds that are produced by purebred parents.

Q.—How is this improvement of live stock produced for market purposes accomplished? *A.*—The best breeders of purebred live stock make every effort, by selection, proper mating and good care, to produce animals which will serve a given purpose to the greatest possible degree. Most of the animals so produced are sold to be mated with grade, and sometimes scrub, females. Thus, what is known as a "grading-up" process takes place. One male serves from forty to eighty females and becomes the sire of all the offspring in the herd. Thus, the good male exerts a wonderfully important influence for good on the offspring. The more often this plan is practiced in a herd, the higher grade the herd becomes. This is called "grading-up by the use of purebred sires."

Q.—In what essential ways does the use of purebred sires improve market live stock? *A.*—(a) It makes for uniformity among the offspring because the purebred sires have been produced from long lines of ancestors selected and bred for a specific purpose, and, consequently, they are "strong breeders," and their offspring tend to resemble one another.

(b) It improves the individuality of the animal for the purpose intended because purebred sires have been bred for that particular purpose for many generations and they transmit their characteristics.

(c) It produces animals which find a more ready market because purebred animals have been produced with the idea in view of making them meet the special market demands, and their offspring being like them tend to meet those market demands.

(d) Because of the fact that the offspring of purebred sires are more uniform and possess individual superiority and meet a greater market demand, they do, if properly handled, yield larger profits than scrub animals.

(e) Aside from all these facts the good live stock which goes from any farm to the market is a credit to the producer and to the community, and a source of satisfaction to the farmer who has produced and handled it.

Q.—Can the average farmer afford to use purebred males? A.— The average farmer can afford to use nothing other than a good purebred male because:

(a) A good purebred male possesses the characteristics desired in market animals and is the result of such a plan of breeding that he transmits those qualities to his offspring.

(b) While the average female becomes the parent of from one animal a year in the case of horses and cattle, to ten to fifteen in the case of hogs, the average male can become the parent of forty to sixty times as many offspring in one year. This is true because in the average herd, one male mates with forty to sixty females within the year. In short, the sire is half the herd because he is the male parent of all the offspring.

(c) Because of his superiority the good purebred male improves the quality of all his offspring and increases the value of those which are destined to be fattened for market.

(d) A most important result that the average farmer gets from the use of a purebred male is that he may start with a band of scrub females, mate them to a purebred male, and save their female offspring, which will be grades much better than their mothers.

Q.—How can the average farmer best proceed to buy a purebred male? A.—The average farmer can best proceed to buy a purebred male by deciding on the number of females that he wishes to breed. This will depend upon his equipment for handling them, his available feed stuffs, and his other farm plans. The price that he can afford to pay for a male will depend somewhat upon the number and kind of females he has to breed. If he expects to breed a herd of forty cows and a good purebred male can improve the value of the calves at weaning time to the amount of five dollars a head, or $200, it is evident that he can pay $200 more for a good purebred male than a scrub sire would cost. The farmer can use the sire for a year and have him left at the end of the season, or if he uses him two years he can pay $300 more than a scrub sire would cost and have the male left at the end of two years, and $100 additional on the price of his calves.

Every man should figure carefully on the price that he can afford to pay for a male to use on his herd of grade females, but he should bear in mind that the difference in the selling price of the offspring of a purebred male as compared with the offspring of a grade male is relatively great.

After deciding upon the opportunity for using a purebred male, it is a safe policy to locate a reputable dealer who handles good animals, tell him the needs and secure his assistance in the selection of the male.

Q.—Can the average farmer afford to breed purebred live stock? A.—The average farmer can afford to breed purebred live stock, provided he is willing to give the care and attention that is required to make a success of it. Before engaging in the production of purebred live stock, however, it is essential that he decide upon the breed to be handled and see that affairs are so arranged that he can stay in the business for a relatively long time. The greater number of the failures among purebred live stock men are men who go in in a hurry without careful consideration and are equally anxious to get out; and they make every effort to do so when the business suffers a temporary setback. Great breeders are the men who have developed ideals, established herds, and spent a lifetime in herd improvement.

Q.—What is the best way to start breeding purebred live stock? A.—The best method for the average man to follow in establishing a herd of purebred live stock is to begin with the use of a purebred male on grade females. With this sort of equipment a man learns how to manage and care for breeding animals and their young. He learns something about the characteristics of successful breeding animals, and, in short, familiarizes himself with the business. One who contemplates establishing a purebred herd should begin a study of pedigrees, blood lines, the market for purebred animals, methods of advertising and methods of purchase, sometime before he expects to start in the business. He is then equipped to buy a few females with breeding and individuality of a sort which makes them highly valuable as breeding females in a herd. The males produced, if of satisfactory character, may be sold privately or at public auction thru combination sales fostered by the various associations. If unsatisfactory, they should be put in a feed lot. The females may be added to the breeding herd, and gradually the grade females can be eliminated. It will be only a short time until a high-class herd of purebred females is thus developed. Close observation and study should be made of the developing herd and the outlet for purebred live stock. The business should at all times be kept on a safe financial basis.

References:

Mo. Agr. Exp. Sta. Circular 65.—Advantage from Use of Purebred Rams
Mo. Agr. Extension Service Circular 33.—Community Live Stock Breeding.

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AGRICULTURAL EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 64 COLUMBIA, MISSOURI FEBRUARY, 1919

Potato Culture for Missouri

J. T. Rosa, Jr.

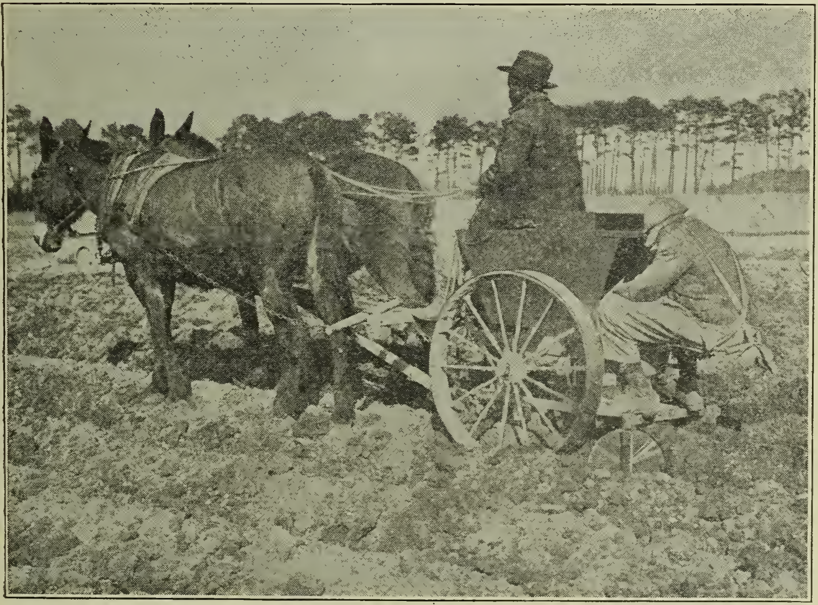

Fig. 1.—A potato planting machine in operation

Missouri does not rank high in potato growing altho the Irish potato is one of the most important crops in the state for home gardeners and truck farmers. The production of early potatoes on a large scale for shipment has proved profitable in several localities. This business is capable of expansion, for Missouri does not produce as many potatoes as the state consumes, and several large potato markets in neighboring states are also available. In 1917, Missouri produced a record crop of nearly ten million bushels on 109,000 acres of land. The average acre-yield of potatoes in Missouri for the last ten years is sixty-nine bushels, which is far too low even for a section growing mostly early varieties for summer and fall use. The yield can be increased by better fertilization, by the use of better seed and larger seed pieces, and especially by controlling insects and diseases, which in the past have been allowed to attack the potato crop almost at will.

The Irish potato is one of the cheapest and most wholesome articles of food. Since the amount of potatoes used in a year by an average Missouri family is between fifteen and twenty bushels, families having access to large garden plots will find it profitable to grow their whole season's supply. If grown as an early spring crop when retail prices are highest, the homegrown supply will afford the greatest saving. In an experimental garden at the University of Missouri in 1918 early potatoes were grown at a cost of about fifty cents a bushel, as compared to the retail price on the same date of fifty cents a peck.

POTATO SOILS

Practically all soils in Missouri will grow potatoes if made sufficiently rich. Preference should be given the more sandy soils, as these favor a quick early growth and produce clean tubers of high quality. The black prairie lands and the shingly soils in the Ozark region also grow good potatoes, but stony soils should not be used for extensive plantings. Even red clay soils will grow potatoes, but this type is undesirable because it is generally poor and also hard to handle. The loess soil along the Missouri river is capable of growing splendid potatoes.

Land intended for potatoes should be manured and plowed, preferably in late fall. Early spring plowing is satisfactory on land which was cultivated the preceding year. However, it is often desirable to grow potatoes on land which has been in sod, for the soil will be comparatively free of potato pests, and still more important, it will contain a large quantity of organic matter. Either bluegrass sod or clover sod will make good potato land, but unless fall-plowed the tough sod will give considerable trouble in planting and cultivating. An emergency or make-shift method of planting potatoes on sod land is to drop the seed behind the plow when breaking the sod. If seed are dropped in every third or fourth furrow, the rows will be about the right distance apart. This method may give fair results in a favorable season.

Potatoes will produce good crops only on fairly rich soil. If the soil is known to be poor, lacking plant food and organic matter, it must be brought to a fair state of fertility before much can be expected. Plowing under a heavy sod is very helpful, if sufficient time is allowed for the sod to rot before the potatoes are planted. Generally the best fertilizer for potatoes is rotted stable manure. It should be spread broadcast and, if possible, disked into the soil before plowing. It may be used in any quantity up to fifty tons to the acre. For a garden the equivalent of this would be one load for a plot thirty feet square. In addition to manure, any fertilizers containing phosphorous are valuable for potatoes. Acid phosphate or bone meal are recommended for use on potatoes, at the rate of 400 pounds to the acre. Hardwood ashes are also valuable on account of the potash they contain. Other potash fertilizers are too expensive just now to justify their use in Missouri. Under normal conditions a mixed fertilizer containing 5 per cent nitrogen, 8 per cent phosphorus, and 3 per cent potash would be advisable. The fertilizer may be applied broadcast and worked in before planting the seed, or it may be drilled into the row at planting time. In the latter case, the fertilizer should be mixed with the soil in the open furrow before dropping the seed; otherwise the seed might be injured by coming in immediate contact with such fertilizers.

POTATO SEED

Much of the success of the crop depends on the seed and the way in which it is handled. As a general thing seed potatoes obtained from Northern sections give best results. Wisconsin and Michigan are now producing "certified" potato seed of standard varieties which is true to name, of good type, and free from disease. Such seed is far more valuable to the potato grower than ordinary seed potatoes found on the market. Nebraska is also ready to produce high-grade seed potatoes suitable for use in this section. The use of homegrown seed saved from the summer crop is possible, if the potatoes are allowed to remain in the ground until fall, then dug and stored in a cool cellar or in a well protected bank outdoors. Probably the crop from such seed will be less satisfactory, generally, than that obtained from fresh Northern seed.

A new method for obtaining seed potatoes in this state is now being tried out. It consists in planting a late or second crop about July 1. The storage period for the tubers produced by this crop will be much shorter than for seed potatoes saved from the spring crop.

Also the tubers from the late crop will be "immature" because the growing season is cut short by cold weather. Such tubers produce more vigorous and productive plants than those which are more fully matured. Results from the use of second-crop homegrown potatoes for seed purposes have been quite encouraging. In favorable seasons, a crop planted about July 1 will continue growing until late October. If moisture is abundant the fall crop may be more productive than the ordinary spring crop, because the cool fall weather is ideal for growth in the potato. This crop is also of good table quality and may be kept in fine condition for winter use if handled carefully to avoid skinning and bruising the potatoes. When grown for food purposes alone, there are several varieties specially adapted to planting in the fall, altho unsatisfactory when planted in the spring. The McCormick, Peachblow and Banner belong to this group.

The chief objection to growing a second or fall crop of potatoes is the difficulty of obtaining suitable seed at the proper planting date, July 1. Old potatoes kept in ordinary storage will be covered with sprouts and so shriveled as to be almost worthless. The solution for this difficulty is to place the seed potatoes in cold storage before April. In this way the seed are kept dormant and in perfect condition until midsummer. In the southern part of the state it may be possible to secure seed for the fall crop by using tubers from the spring crop. These should be spread in a shaded place for two weeks before planting. This treatment results in a fair stand and satisfactory crops.

CUTTING SEED

As a general thing, medium-sized, smooth, regular, tubers which are free from disease, are most satisfactory seed. Many tests have been made at the various experiment stations to determine the best size of seed piece for planting. The general conclusion is that the yield increases with the size of the seed piece, to a certain limit. Seed pieces are generally cut too small, because of a mistaken idea of economy in the amount of seed to use. It seems that for Missouri conditions, a seed piece weighing about 1½ ounces is most satisfactory, and at the same time is economical. Each seed piece must contain at least one good eye. The strongest eyes are at the tip end of the tuber. To get as many seed pieces as possible which contain these strong eyes, it is best first to cut the tuber lengthwise. Then each half is cut into compact blocky sections of the proper size. (Fig. 2.) The use of very small pieces, thin or narrow sections, peelings, etc., for seed purposes is to be condemned. Seed should be planted the same day as cut to prevent injury from drying out. In case seed must be cut some days before planting, injury can be largely prevented by dusting the cut seed liberally with sulphur, ashes or slaked lime.

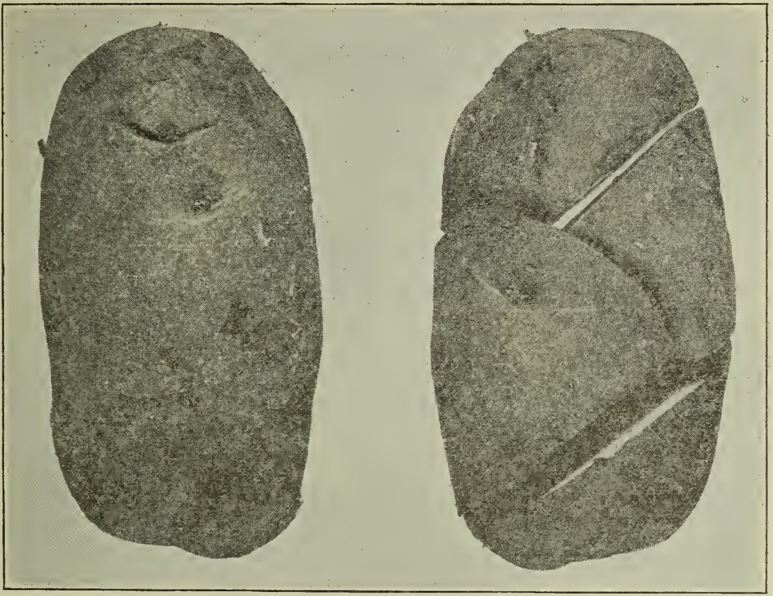

Fig. 2.—The left-hand figure is a half tuber split lengthwise. The right-hand figure shows the piece cut into sections

It is often asked if small unmarketable tubers may safely be used for seed. Tubers between one and two ounces in weight, when planted whole, will give satisfactory crops. This is especially so in the case of small immature tubers from the fall crop grown at home. Tubers weighing more than two ounces may be split lengthwise for planting. Tubers less than one ounce in weight should not be planted under any circumstances. It would probably be bad practice to continue planting the small tubers from the same stock year after year. Small whole tubers are more satisfactory for seed if they have been allowed to sprout before planting.

SPROUTING SEED

To speed up the spring potato crop, gardners may sprout the seed tubers before planting. This results in quicker growth, an earlier crop and a higher yield than is obtained when ordinary dormant seed are planted. The seed should be got two or three weeks before planting time. Only sound healthy tubers weighing not less than one ounce should be used. Spread them out in a single layer on the floor of a light room or on the bottom of a hotbed where they can receive full light. Often a shallow box can be placed in a living room window, in which a peck or two of seed can be sprouted. Under the influence of the warmth and light, the tubers send out stubby sprouts. If the place is too warm or is poorly lighted, these sprouts become long and slender, and are likely to be broken off in planting.

The seed should be planted when the sprouts are about one-half inch long. Cut the tubers in the usual way, with at least one sprout to the piece. These should be planted by hand, with the sprout upward. Market-gardeners often sprout a part of their potato seed for the extra early crop for which high prices are received. The cost of sprouting would prevent this method from paying on a large scale.

SEED TREATMENT

Several diseases of potatoes, including the common scab, are spread by means of infected areas on the surface of the tubers, as well as by disease organisms clinging to the surface of healthy tubers. To avoid injury to the crop, disinfect the seed before cutting and planting. The easiest treatment is that employing a solution of one pint of commercial formalin in 30 gallons of water. The seed tubers are placed in sacks or baskets for immersion in the solution. The old method was to use this solution cold, soaking the seed from 1½ to 2 hours. A quicker and more efficient method is to heat the solution to about 122° F. and soak the seed only fifteen minutes. A wooden barrel or tub may be used for the treatment. The formalin solution can be used over and over for treating. One pint of formalin, costing about fifty cents, will disinfect twenty-five bushels of seed, or enough to plant two acres. The profit effected by increased yield of marketable potatoes and their non-scabby appearance will pay many times over for the investment in disinfectant. It is true that good crops are often grown in Missouri without disinfecting the seed, but it its better to insure the crop from at least one danger when this can be so cheaply and easily done.

Common corky scab may not be completely controlled by seed disinfection, as the scab organism often exists in the soil naturally, and it may be caused to spread by the use of lime and fresh manure just before planting potatoes. In such cases the seed disinfection would not entirely prevent scabby potatoes altho it would reduce the amount of common scab, and largely prevent the appearance of the powdery scab and Rhizoctonia.

VARIETIES

There are many varieties of the Irish potato, which differ greatly in their adaptation to Missouri conditions. Varieties of potatoes are usually classed as early or late, according to the length of season required to mature the crop. In the North, where the season is cool and moist, the late varieties are most productive. In Missouri, however, the hot, dry weather puts an end to growth in the potato plant too soon for a late variety to mature a satisfactory crop. Therefore, in this state, the early varieties which mature their crop before the heat of summer comes on are the only profitable ones to grow. When potatoes are grown for market, it is especially necessary to plant early maturing varieties, for it is the early crop which brings best prices. The following named varieties are the only ones which need be considered for spring planting, altho there may be a number of other early varieties, at least in name.

EARLY VARIETIES

Early Ohio.—A good early variety, at present very popular in the Missouri Valley. The tubers are rather long, with smooth rounded ends. The color is light pink, the shade varying according to the soil and the degree of maturity. The table quality is good and the yielding power seems fully equal to that of the other early varieties.

Irish Cobbler.—A good early variety grown extensively in the East and South, and gradually replacing the Early Ohio in the Missouri Valley. The tubers are only medium sized, but the plants are very productive. The tubers are quite round, and the best type is somewhat flattened. The color is white and the table quality is good. This variety is a little preferable to the Early Ohio in that it is more resistant to injury by hot dry weather and diseases.

Early Rose.—This is a good old variety which is still very satisfactory. The tubers are long, cylindrical, smooth, and colored a faint pink.

Bliss Triumph.—This is now being grown extensively for an extra early crop. While it does mature very early, in most cases it would be best to discard this variety for one of those already mentioned, because of the low yield and small size of the tubers; also, the tender plant is very susceptible to injury by tipburn and other diseases.

FALL VARIETIES

For planting about July 1 for the second or fall crop, any of the foregoing varieties will be satisfactory. If the object in growing the fall crop is not for next year's spring seed, but rather for food production, some one of the special fall varieties may be grown. Lookout Mountain or McCormick is the variety which seems especially suitable for this season. It is very productive, and has the ability to resist heat and drouth which generally prevail in the late summer. The old Peachblow, with which our grandfathers are most familiar, is still satisfactory when grown in the fall. In fact the appearance and quality of the Peachblow is superior to that of the McCormick, but the yield is somewhat less. Banner and Enormous are two other heavy yielding fall varieties.

All these special fall varieties are practically worthless if planted in the spring. Seed for the July planting must be saved from the preceding fall's crop, cold storage being most satisfactory.

PLANTING

Most of the potatoes planted in Missouri are dropped by hand; in fact this is the only practicable way when planted in home gardens and in small fields. Where five acres or more are grown it is profitable to use a planting machine. There are several good ones on the market, costing from $75 to $100. These machines, drawn by two horses, will perform all the operations necessary in planting. The row is opened, fertilizer drilled into the row if desired, seed are dropped at the desired distance, and the row is covered with a rounded ridge. Several potato growers who live near each other should own a potato planter on a co-operative basis. About four acres a day is the average area planted with a machine.

In planting by hand, the rows are first opened the desired distance apart with a one-horse turn plow. A furrow three to four inches deep is sufficient. If gardeners find it inconvenient to use a plow, a wheel hoe with a turn-plow attachment will do. If fertilizer is to be used, and has not already been applied broadcast, it is drilled into the open furrows and mixed with the soil somewhat by running a cultivator thru the rows. This also loosens the soil in the bottom of the furrow, making a better seedbed. As promptly as possible, the seed should be dropped and covered. Detrimental effects follow if the furrows are left open to dry out either before or after the seed are dropped. The seed should be covered at first five inches deep by means of a slight ridge over the furrow. Two weeks after planting this ridge is worked down by raking off the crest with a hand rake or by dragging the field cross-wise with a spike-toothed harrow. About the time the sprouts are beginning to come thru, a second raking or dragging should be given, working in the same direction as the rows. These two draggings reduce the depth of the seed, and leave the soil in the row soft and loose, so that the sprouts may push thru easily. Also, many germinating weed and grass seed directly in the row will be destroyed. These would be difficult to reach in later cultivations.

Planting distance.—The early varieties will give good results if planted in rows 3 to 3½ feet apart, with the seed pieces or hills spaced about 15 inches apart in the row. In gardens, where all cultivation is done by hand, the rows may be spaced as closely as two feet apart. Some allowance may be made for the fertility of the soil, planting somewhat closer on rich soils than on those which are relatively poor. Gardeners often ask if it is advisable to place two seed pieces in each hill. There is no necessity for this, and in most cases it is merely a waste of seed. If seed pieces ranging from 1¼ to 1½ ounces each are planted at the above-stated distances, about sixteen bushels of seed per acre will be required. This is the amount which has been found most economical for the bulk of crop produced, altho it is considerably more than is now being used by the average potato grower. The use of more seed per acre in the form of larger seed pieces, seems to offer one of the quickest ways in which the yield can be increased. In occasional seasons the price of seed is abnormally high and it is then economical to reduce the amount of seed somewhat.

Planting date.—Generally speaking, the earlier potatoes are planted in Missouri, the better the results will be. In the case of Early Ohio potatoes planted at Columbia, March 26, 1918, a stand of 94 per cent was obtained as compared to an average stand of 71 per cent from the same lot of seed planted two weeks later. The earlier planted lot also produced 31 per cent more potatoes than the later planting. In the average season, potatoes should be planted in central Missouri before the last week in March, a week or two earlier in the southern part of the state and a week later in the northern section. This does not mean that planting in April is impracticable, but it seems likely that the returns from an early planted crop will be much more satisfactory under Missouri conditions. The reason is that the early planted potatoes have a longer season of favorable growing weather, before the crop is matured by the dry hot weather. To plant potatoes early means that fall plowing and manuring is an additional advantage. Often early planted potatoes will have their shoots above the ground in time to be caught by late frosts. A light frost will do no harm, but if it becomes cold enough to freeze, the plants will be killed back to the ground. In case the sprouts are not more than two or three inches high, they will quickly come up again, but if, as sometimes happens in a very favorable spring, the sprouts are several inches high, the injury will be much more severe. To guard against this danger, it is a good practice to ridge up the rows again just after the majority of the sprouts have come thru. This is done most conveniently by running a light furrow along each side of the row, forming a light covering over the young sprouts. This ridge is mostly worked down by later cultivations.

CULTIVATION

As has been stated, some of the most important cultivation can be given before the potato plants come thru the ground. This must be followed during the early part of the growing season by several good cultivations between the rows. For field work the ordinary two-row corn cultivator is an excellent tool, if the shovels are set so that those nearest the plants do not run too deeply. Another good tool for cultivating between the rows is the one-horse cultivator. This tool can be used nicely to "lay-by" the potato crop, if a sweep shovel is attached in the rear. When used in this way a low ridge is formed by throwing earth toward the plants. An excessive ridge is undesirable, while a slight ridge will favor tuber formation, and also protect tubers near the surface from becoming sunburned. When properly cultivated in the early part of the season, no hand cultivation should be necessary in the potato field. It is a good plan to discontinue all cultivation after the plants begin blooming. Shallow cultivations thru the middle of the rows after this time may be good practice in case the soil is dry and the crop is suffering from lack of moisture.

The garden crop of potatoes can be cultivated entirely by hand, using a rake before the plants are up, and afterward an ordinary hoe or a wheel hoe. The objects are the same as in field cultivation; that is, to keep out weeds and grass, to keep the soil fairly loose and to form a low ridge toward the end of the cultivating season.

INTERCROPPING POTATOES

It is quite desirable to intercrop the potato patch in the home garden with other vegetables. The potatoes do not make use of the space between the rows for some time in the early part of the season, even when the rows are as close as twenty-four inches. Therefore, a row of quick maturing vegetables can be planted between rows of potatoes and be removed by the time the potatoes need the space. Radishes, sets for green onions, lettuce, spinach or mustard would fit in well. It is also possible to plant a row of sweet corn in the potato middles about two weeks before the early potato crop is dug. If the digging is carefully done, the corn will not be injured and can start growing vigorously as soon as the potatoes are removed. In field culture it is undesirable to intercrop potatoes. The soil is left in fine, loose condition by the potato crop, and early potatoes should be followed by turnips, spinach, etc., for fall use.

STRAW POTATOES

Growing Irish potatoes under a straw mulch is an excellent way to handle small areas for home or market garden use. Leaves, corn stalks, strawy manure or grain straw may be used for the mulch. The seed are planted as usual, except that they are placed in shallow rows two inches deep instead of the usual four inches. The mulch material is spread over the surface to a depth of four or five inches before the potato plants come thru the soil. The stems push thru the mulch and the plants grow luxuriantly above it, while beneath the mulch the tubers are formed, partly in the soil and partly in the mulching material. These tubers are easily harvested, are clean and healthy, and are exceptionally good keepers in storage.

The mulch material serves to protect the roots and tubers, and retains the soil moisture so that the plants continue to grow during hot dry weather, when potatoes not mulched would be either stunted or killed. This practice is worthy of consideration in Missouri, where the hot dry summers are harmful to the crop. No cultivation is necessary after mulching; for this reason the rows may be placed close together. The decayed organic matter from the mulch which is worked into the ground after the potato crop is removed, improves its physical condition immensely, and puts it into far better crop-producing condition. The mulch can be placed around potatoes and other crops after they have made some growth, but the earlier the mulch is placed, the better the results will be.

CONTROL OF POTATO PESTS

Aside from the scab diseases, which are controlled by disinfecting the seed before planting, the chief enemies of the potato crop in Missouri are the Colorado potato beetle, or "potato bug," and tipburn, a physiological trouble of the leaves caused chiefly by hot, dry weather. Where it is desired to control only the beetles there are two methods of attack. The one probably best, is spraying the plants well with arsenate of lead at the rate of 1½ pounds of the powdered form to 50 gallons of water. The formula for a small quantity of sprav material would be 2½ ounces to 5 gallons of water. In place of the arsenate of lead, which is now quite expensive, it may be advisable to substitute a cheaper arsenical. Arsenate of lime and arsenite of zinc have been found equal or superior to arsenate of lead. They are used at the same strength. The time to start spraying may be judged by watching the plants closely in the early part of the season. Shortly after the large bright yellow egg masses of the beetles are noticed on the under surface of the leaves, the first spray should be given. It is poor policy to delay spraying until the plants are covered with bugs for a great deal of damage will have been done before the bugs are controlled.

Since many gardners are not equipped with spraying machines of any sort, they may prefer to dust the plants with poison in dry form. This is a simple and quite effective method for controlling the bugs, altho it may be more laborious and expensive than spraying. The material best adapted for dusting is paris green diluted with 50 to 60 times its weight of air-slaked lime. Paris green has been used considerably for spraying in the liquid form, but is far less satisfactory than arsenate of lead; in fact it may do as much damage as the bugs by burning the foliage. Arsenate of lead in the dry form can also be used for dusting for potato bugs, if applied at the rate of one part to 25 parts slaked lime. In dusting plants the material may be sprinkled on lightly by hand or it may be shaken thru a cloth sack. There are cheap and efficient "powder guns" on the market, which can be used to cover the plants with the dusting material.

Tipburn, the disease which causes most loss to potatoes in Missouri, is caused chiefly by hot dry weather. It appears generally in the latter part of the growing season about the time tubers are being formed, and coming at this period, the yield is reduced. Tipburn first causes the tips and margins of the younger leaves to curl up and turn brown along the margins and at the tip. Later most of the leaves on the plant may become brown and dry. Being caused by weather conditions, tipburn is hard to control. There is some difference in the amount of the burning sustained by various varieties, altho most of the early varieties are more or less severely attacked. The Irish Cobbler has proved most resistant, while the Early Ohio and Early Rose have been moderately affected. The Triumph variety is much more susceptible than any other. Spraying with bordeaux mixture is the only means of control that has given promising results thus far. The 4-4-50 formula is used in preparing the bordeaux mixture. Take 4 pounds each of copper sulphate and unslaked lime, dissolve each in 25 gallons of water, and pour the solutions together into the sprayer. About three applications of bordeaux, ten days apart, will benefit the potato crop materially. Apply the first spray just before the plants begin blooming. While control of tipburn is the main object in using bordeaux in this section, this spray also prevents a fungous disease known as early blight, which attacks the leaves and often does considerable injury. When spraying with bordeaux mixture it is well to add to it arsenate of lead or some other arsenical for control of the beetles. Thus all the pests can be met with a single combination spray. However, it may be necessary to dust or spray for the bugs once or twice before using the combination sprays.

It is easy to make up spray mixtures at home, but unless the gardener is foresighted enough to provide the materials in advance of the spraying season he may sustain serious loss. Local dealers often cannot supply the necessary spray materials. There are various patented spray mixtures on the market which are generally more expensive and less effective than home-mixed spray. They are advantageous in that they are convenient, may be had in small quantities, and are generally ready to use at once. The commercial grower cannot afford to use such materials.

For applying sprays in the field, there are a number of efficient power sprayers on the market. The spray pumps on these machines are generally operated by wheel traction, and the machine is drawn by two horses. The nozzles can be arranged so that two or more rows of plants can be sprayed at once. A power sprayer is a great economy to the grower of a moderately large acreage of potatoes.

HARVESTING THE POTATO CROP

Since early varieties are grown most extensively in Missouri, the bulk of the crop is dug in the summer for immediate consumption or shipment. The earlier the crop can be dug, with a fair yield, the more profitable it will be. For home use the harvesting may start as soon as tubers of edible size are found. Only a small quantity should be harvested at this early date, however, as it is wasteful to dig the crop before it is fully grown unless the potatoes can be sold for a high price. It should be remembered that potatoes continue growing until the vines are dead. When the crop is grown entirely for home use, the bulk of it should be left in the ground until early autumn. Potatoes dug during the heat of summer will not keep for any length of time, therefore, harvesting the crop for winter use must be deferred until the approach of cool weather.

For harvesting the garden crop of potatoes, either the common flat-tined spading fork or the hoe fork may be used, forking out the individual hills with as little injury to the tubers as possible. For digging potatoes on a large scale, a two-horse turn plow is used, running the plow under the row of potatoes, so as to turn out the hills. For harvesting on a larger scale, the machine diggers are used. These are drawn by four to six horses, depending on the conditions. There are also two-horse machines which have a small gas engine to operate the digging machinery. Digging machines are now being operated by several large potato growers in Missouri. Where potatoes are grown on a somewhat extensive scale, the digging machine is a great labor saver, in fact it would be impossible to harvest the bulk of our potato crop if the machine diggers were not so efficient. The digger leaves all the potatoes in the row lying on the surface of the ground, where they can be gathered up by hand with a minimum of labor. It is always advisable to allow the potatoes to remain on the ground for an hour or two after digging, as this toughens the skin against bruising and decay resulting from handling. It also loosens the dirt on the tubers and removes some of the moisture from the surface, so that the appearance and keeping quality is improved.

In harvesting and handling potatoes due care must be observed to avoid cutting and bruising them, as these become unsalable and generally rot in storage. Lug boxes or baskets holding about one bushel are the most convenient articles in which to gather and handle potatoes. Sacks should not be used except for potatoes which are fully matured and are therefore less likely to be bruised, or for potatoes which are to be used at once.

A federal law requires all price quotations on Irish potatoes to be based on one hundred weight. It is to the interest of both grower and consumer to handle potatoes entirely by weight. A bushel legally weighs sixty pounds.

GRADING

To prevent the marketing of small and worthless potatoes mixed with table stock, and thereby lowering the value of all, standard grades for potatoes were established in 1917 for the United States by the U. S. Food Administration and the Department of Agriculture. While grading in accordance with these rules is not now compulsory, they should be generally observed by growers and shippers. To as great an extent as possible, grading should be done by the grower so that the culls may be kept on the farm and fed to stock. Careful grading will increase the demand for potatoes as well as the price. It is also possible to get loans from Federal Reserve banks on receipts for potatoes in suitable storage, if these potatoes are graded to conform to the rules.

U. S. Grade No. 1.—This grade shall consist of sound potatoes of similar varietal characteristics, which are practically free (a) from dirt or other foreign matter, frost injury, sunburn, second growth, cuts, scab, blight, dry rot, and damage caused by disease, insects or mechanical means. The minimum diameter (b) of potatoes of the round varieties shall be one and seven-eights (1 7/8) inches, and of potatoes of the long varieties one and three fourths (1¾) inches. In order to allow for variations incident to commercial grading and handling, five per centum by weight of any lot may be under the prescribed size, and in addition, three percentum by weight of any such lot may be below the remaining requirements of this grade.

U. S. Grade No. 2.—This grade shall consist of potatoes of similar varietal characteristics, which are practically free (a) from frost, injury and decay, and which are free from serious damage (c) caused by dirt or other foreign matter, sunburn, second growth, cuts, scab, blight, dry rot, or other disease, insects or mechanical means. The minimum diameter (b) shall be one and one-half (1½) inches. In order to allow for variations incident to commercial grading and handling, five per centum by weight of any lot may be under the prescribed size, and in addition, five per centum by weight of any such lot may be below the remaining requirements of this grade.

Explanations of Grade Requirements: (a) "Practically free" means that the appearance shall not be injured to an extent readily apparent upon casual examination, and that any damage from the causes mentioned can be removed by the ordinary process of paring without appreciable increase in waste over that which would occur if the potato were perfect. Loss of the outer skin (epidermis) only shall not be considered as an injury to the appearance.

(b) "Diameter" means the greatest dimension at right angles to the longitudinal axis.

(c) "Free from serious damage" means that the appearance shall not be injured to the extent of more than twenty per centum of the surface, and that any damage from the causes mentioned can be removed by the ordinary process of paring without increase in waste of more than ten per centum by weight over that which would occur if the potato were perfect.

STORAGE

Altho the bulk of the Missouri potato crop is sold in the summer for immediate consumption, many families successfully store their entire winter supply. This is advisable when a sufficient quantity of homegrown stock is available. Many growers also store their seed. The potato is easily kept if not handled roughly, and if cool, somewhat moist storage conditions are provided. Potatoes keep very well in bins holding ten to fifteen bushels in a cool house cellar or in an outdoor cellar. Probably the outdoor cellar is more satisfactory for storage because it is cooler.

Banks or pits are also satisfactory for storing potatoes where no cool cellar is available. The pit is prepared very simply. Select a well-drained spot, if possible, located near a tree or other shelter where it will be shaded from the sun. Scoop out several inches of soil, down to solid earth, from an area large enough to receive the potatoes. Add a layer of potatoes about one foot deep each day, keeping the pit covered from day to day with tarpaulin or straw. The potatoes should not be piled more than four or five feet deep. When the pit is finished it should be covered with a layer of straw deep enough to exclude light and heat. Weight the straw with boards to prevent the wind from blowing it. An opening should be left at the top to provide ventilation and to permit the escape of excess moisture and heat from the pile of potatoes. If the location is such that surface water will not drain readily, dig a shallow ditch around the pit, and provide an outlet so that the water which runs into it can escape. The potatoes should not be dug and placed in the bank until the approach of cool weather, but the pit must be covered with earth before freezing weather. About ten inches of soil will be necessary to protect the potatoes. This soil should be placed on top of the straw. Potatoes may be kept in the bank until the following spring but if small quantities are needed for use during the winter an opening can be made in the bank.

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A. J. Meyer, Director

CIRCULAR 65 COLUMBIA, MISSOURI MARCH, 1919

Planting a Backyard Orchard

J. C. Whitten

Question.—Is it possible to make a start toward a small home orchard in the same spot where I have my garden? Answer.—Yes; everybody who puts out a garden can just as well be growing a small home orchard in it. This orchard will make as valuable a return for the average family as does the vegetable garden itself. The cultivation given the vegetables is just what is required by the young trees.

Q.—What fruits do you recommend? A.—Apples, Cherries, plums, peaches, and pears. Select fruits that will furnish a succession from the Early Richmond cherry, which ripens in May, up to the late-keeping apples like Ingram and Lansingburg, which will keep until the following May.

Q.—How many trees of each variety planted would you suggest? A.—One tree of each variety is enough. If, however, a larger number of trees is desired they should be mainly the long-keeping winter apples.

Q.—What, in the order of ripening, are some of the leading varieties of cherries, plums, peaches and pears? A.—Cherries: Early Richmond, Montmorency, and English Morello. Plums: Chabot, Burbank, Wild Goose, Wayland, and Damson. Peaches: Early Wheeler, Carmen, Elberta, Krummel, and Heath Cling. Pears: Seckel, Anjou, Lincoln and Keiffer.

When would you suggest picking the pears? A.—If the pears are picked when full size but before they ripen on the tree wrapped in paper, and allowed to ripen in a dark, cool place, their quality is greatly improved. Even the low-quality Keiffer then becomes a good pear. The last of its fruits will keep until Christmas in ordinary storage.

Q.—What varieties of apples would be good for a small backyard garden. *A.*—A desirable planting for early fruit might be Yellow Transparent, Duchess, Benoni, Wealthy, and Maiden's Blush.

These will fill the season from June until August. They should be followed by varieties which are at their best from early winter to late keepers—Grimes, Jonathan, Delicious, Stayman, York, Ingram and Lansingburg.

Q.—How far apart should trees be planted? *A.*—Apple trees should be planted twenty-five to thirty feet apart each way, the plum and peach trees sxiteen to twenty feet apart.

Q.—What is the best age of trees for planting? *A*—One-year-old trees, for the most part, should be selected for planting, altho in the case of the apple, sour cherry and pear, two-year-old trees will usually transplant successfully, provided they have not grown too large.

Q.—When should trees be planted, and how deep should they be set? *A.*—The trees may be planted either in fall or spring, and they should be set just about as deep as they stood in the nursery.

Q.—What of the roots of the trees? *A.*—The roots should take their natural spread in the soil, never being bent or twisted in planting. In filling in the soil about the roots should be tramped very firmly from the bottom of the hole up, so the roots will not dry out.

Q.—Should trees be pruned back when planted? *A.*—As soon as the trees are planted their tops should be pruned back somewhat, Peach trees and Japanese plums should be pruned to single whips by removing the main limbs and shortening the main stem to two and one-half to three feet in height. These trees will readily sprout new branching systems from the trunk. Sour cherries, unlike the peach, do not readily sprout new limbs from the trunk. They grow best from the active buds which are at the terminal or newest part of the branches. Three or four main spreading limbs should be left to form the framework of the tree. The other branches and central trunk should be cut out entirely. Apples, pears and American plums should be pruned back with a medium degree of severity. In general, the side limbs should be cut back one-half and the central leader shortened somewhat.

Q.—Should the young orchard be cultivated? *A.*—The fruit trees should be given as thoro cultivation as corn or vegetables, at least until they reach bearing age.

Q.—What would you suggest as desirable to grow between the young trees? *A.*—Any kind of garden vegetables, or strawberries and other small fruits may be grown between the tree rows. If a rank growing crop like corn grows higher than the trees, one row of corn should be left out, preferably north and south, in the tree row so that the fruit trees will not be shaded by it until they get well established. Low growing vegetables or berries may be planted as close to the trees as desired.

PRUNING APPLE TREES

Question.—How should apple trees be pruned? *Answer.*—In pruning apple trees one should aim to secure a low, broad-spreading head, or branching system, with open center to admit filtered sunlight from above.

Q.—How many lower limbs should be secured? *A.*—Three to five main lower limbs should be secured as an outward spreading framework for the tree.

Q.—In what part of the tree should most of the pruning be done, and why? *A.*—Most of the pruning should be done toward the top, rather than cutting off essential lower limbs beneath. High-growing branches toward the center may be cut back to outward growing side limbs. This tends to secure a broad, low spread of limbs rather than allowing the trees to get too high in the center. It also admits sunlight from above. This will enable fruiting spurs and fruit to develop thruout the body of the tree. If the tree is allowed to make too much tall central twig growth it will shade out fruiting branches in the body of the tree so they cannot bear.

Q.—What of pruning old trees? *A.*—If the trees are old and have a large number of main limbs crowding each other badly they should be thinned out.

Q.—When may pruning be done? *A.*—Pruning may be done at any time in the winter whenever the wood is not frozen. If necessary, judicious additional pruning may be done in spring and early summer up to the middle of July.

Q.—What precautions should be observed in pruning? *A.* In pruning, cut all the branches close so as to leave no knot. A knot cannot heal over. A close-cut wound allows the surrounding growing layer to close quickly over the wound.

Q.—Is painting or other treatment of wounds desirable? *A.*—Yes. Paint all the larger wounds with common house-paint or with a good pruning compound such as is sent out by the leading paint companies. Dead, cankered areas on the sides of the trunk or main limbs should be cleaned out. Scrape the dead surface clean with a tree scraper out to the surrounding rim of healthy growth. Paint over these cleaned canker wounds with paint and disinfectant. For a quart of paint or pruning compound, dissolve a teaspoonful of corrosive sublimate in about one ounce of turpentine. When stirred until dissolved in the turpentine, mix this disinfectant with the paint and stir well. It will keep canker from spreading or getting into the wounds.

Q.—What kind of a pruning saw is recommended? *A.*—Pruning should be done with a sharp pruning saw, which will make a clean, smooth cut. The best type of pruning saw is one with a strong steel back in which is mounted a slender blade. This is very much like a ham saw, except that the pruning saw blade moves on a swivel at either end so that it can be turned at any angle desired. This enables one to work the saw in angles between limbs.

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A. J. Meyer, Director

CIRCULAR 66 COLUMBIA, MISSOURI MARCH, 1919

Management of Bluegrass Pastures

W. C. Etheridge

Altho the net income from pasture land in Missouri is nearly as great as that from the corn crop, little progress has been made toward learning better methods for producing pastures and increasing their returns per acre. Nearly all ideas on their production and management are based on observation and the incomplete records of practical experience, rather than on the actual results of thoro experimentation. The substance of the following answers to the more common questions concerning pastures is, therefore, drawn largely from such sources of information and includes only very limited experimental evidence. While for average practice in the management of pastures the recommendations indicated in these answers appear sound, it must be understood that special conditions will require special recommendations.

Question.—How may a bluegrass pasture be started on fertile, tillable land? Answer.—Sow timothy and bluegrass with wheat in the fall, adding clover the following spring. After two years of clover and timothy for hay, the land is pastured and the bluegrass fills the sod as the timothy disappears. The acre rates of seeding should be about 8 to 10 pounds of timothy, 6 pounds of bluegrass, and 6 to 8 pounds of clover, using high-grade seed. If it should be desired to turn unusually clean, fertile land into pasture, a sod could be made somewhat more quickly by omitting the wheat and sowing the grasses and clover without a nurse crop. In this case 10 to 15 pounds of bluegrass seed would be sown to the acre.

Q.—How may a bluegrass pasture be started on rough, untillable land? A.—If the land is judged to be fertile enough to produce a good growth of grass, sow in March one of the following mixtures, at the acre rates mentioned:

(1) Kentucky bluegrass, 8 pounds; timothy, 8 pounds; red clover, 5 pounds.
(2) Kentucky bluegrass, 8 pounds; timothy, 6 pounds; red clover, 2 pounds; white clover, 2 pounds.
(3) Kentucky bluegrass, 8 pounds; orchard grass, 5 pounds; redtop, 4 pounds; alsike clover, 2 pounds.
(4) Kentucky bluegrass, 8 pounds; orchard grass, 5 pounds; timothy, 5 pounds; redtop, 3 pounds; red clover, 2 pounds; alsike and white clover, 1 pound each.

A choice of these mixtures would be determined by the fertility of the soil. On the more fertile soil, timothy and red clover or white clover should accompany the bluegrass; but on the less productive soil orchard grass, redtop and alsike clover should be added.

For the drier, more gravelly lands, one of the following mixtures, seeded at the recommended rates per acre, will usually be found satisfactory:

(1) Orchard grass, 8 pounds; Kentucky bluegrass, 5 pounds; red clover, 3 pounds.
(2) Orchard grass, 8 pounds; Kentucky bluegrass, 5 pounds; redtop, 4 pounds; red clover, 2 pounds; white clover, 1 pound.
(3) Orchard grass, 8 pounds; Kentucky bluegrass, 5 pounds; redtop, 4 pounds; red, alsike and white clover, 1 pound each.

On land too dry and poor for bluegrass, but which may produce a fair growth of other grasses, a mixture of 10 pounds of orchard grass, 5 pounds of redtop and 4 pounds of alsike clover is recommended. If a cheaper mixture is wanted the redtop seed may be omitted.

On all types of untillable land the spring seeding of pastures almost invariably gives better results than fall seeding, unless the soil is so weedy that fall seeding is necessary to give the grass an early start in competition with the spring growth of weeds. No preparation of the soil is necessary, other than burning the leaves or other dead plant matter; but after the seed is sown it should by all means be harrowed or brushed into the soil, if the land is clear enough to allow the passage of the implement. It must be understood, however, that a pasture seeded in the spring will yield but little return the first season, unless the soil is very fertile and weather conditions are favorable. If it is necessary to begin grazing by early summer the grass should be seeded with rye or oats, which will furnish considerable pasturage during May and June.

Q.—Why are various other grasses seeded with bluegrass; and how many years are required for bluegrass to fill the sod? A.— The quicker growing grasses, timothy, rye grass, redtop and orchard grass, are used to furnish pasturage while the slow-growing bluegrass is developing. It is also wise to provide against a possible failure of the bluegrass by including other grasses which might prove themselves better adapted to the soil. Two to five years are required for bluegrass to fill the sod, depending upon the fertility of the land and the persistence of the other grasses in the mixture. Under favorable natural conditions there seems to be no limit to its time endurance. But sometimes without any permanent change in natural conditions, the pasture becomes foul with weeds and brush and is thereby made much less productive.

Q.—What causes the pasture to get into this unproductive condition? A.—Overgrazing during a succession of unfavorable seasons, or sometimes during a single season, is probably the most frequent cause. Weeds will thrive during a season unfavorable for the growth of grass and when the light pasturage is continually weakened and reduced by over-grazing, will establish themselves in the dying sod. On the other hand, when a rank growth of grass stands ungrazed for a long time there is a tendency for the sod to become weakened as the result of a superabundant top-growth. Weeds are then able to grow and multiply, but under these conditions they probably never become so numerous and troublesome as under the extreme conditions of over-grazing. While in the ordinary use of pastures under-grazing is not likely to occur, yet it is well to know in advance the result of such practice. Stock will not eat weeds unless forced to do so, but will graze more and more heavily on the diminishing patches of clean grass; consequently the weeds are continually favored in their competition with the grass for soil space, and unless means are taken to check them they may presently overrun and ruin the pasture.

Q. How may unproductive pastures be improved? A.—The first step should be toward the destruction of weeds. Where the land is level and open enough to allow the use of a mower, all undesirable plants should be cut before they make seed. Or the pasture may be fenced off in several areas, taking the weedier ones first, and the stock kept on an area until the weeds are eaten down. In this practice young cattle or sheep should be used.

As the weeds are being destroyed the growth of the grass itself should be stimulated; and according to the present knowledge of pastures the application of stable manure seems the only certain economical means of doing this. Whenever manure is available, apply it to the pasture in light dressings, covering first the scantiest patches, but eventually covering the whole pasture if possible. Another excellent practice is to reseed the more unthrifty patches and then graze them sparingly until they are again thickly revegetated.

Cultural treatment to improve the growth of pasturage, such as disking and harrowing, cannot be recommended for general conditions. Doubtless there are extreme conditions of root-bound sod where cultural treatment would be beneficial in improving the moisture relations of the plant; but these conditions cannot now be clearly defined, and the operation should proceed cautiously, for by tearing the grass roots more harm than good is liable to result.

Likewise the application of commercial fertilizer to pastures is an extremely dubious practice. There is of course a stimulation of plant growth, but at the present high prices for fertilizer no profitable returns may be expected under average conditions. Should a decided shift in the present relative prices of fertilizer and meat occur, doubtless a moderate application of phosphatic material, say 200 pounds of acid phosphate per acre, would be profitable on most soils.

Finally it must be emphasized that the improvement of foul, depleted pasturage is a tedious and expensive piece of work. The labor involved during a season is probably equal to that of producing a crop of corn, acre for acre, and the first returns are much smaller. Improvement can usually be made permanent by two or three years of careful treatment, but in extreme cases it is sometimes more economical to plow the land and employ a rotation of corn, oats and wheat, or corn and wheat, to free it of weeds, returning to pasture by sowing timothy, bluegrass and clover with the wheat. The future condition of the pasture may then be regulated by the degree of grazing. A bluegrass sod thrives best when cropped fairly close, but it should never be eaten into the ground.

When long-established bluegrass becomes unthrifty, the destruction of weeds, the application of stable manure, and the reseeding of the scantiest patches, are in average cases the most practicable means known for its improvement.

Q.—How may cut-over land in the Ozark region be converted into pasture? A.—If the undergrowth is not too thick, grass may be seeded in the spring, using goats to keep down the woods sprouts for two or three seasons following. The grass is more likely to thrive if the sprouts are pastured for two or three seasons before seeding, but the average farmer is not willing to begin the preparation of land so far in advance of its actual use. Meanwhile the remaining trees should be deadened, leaving only a few for shade.

But, if the undergrowth is thick enough to prevent the growth of grass, it must be cut and burned before seeding. Late in May and in June, when there is a full growth of leaves, cut the brush and leave it well spread over the ground. On a still day in August or early September, when a fire will run slowly and make great heat, burning the brush and stumps will not only clear the land for seeding but will also kill most of the weed seeds. It is extremely important that all surface stuff be cleanly burned away, so that the seed may easily reach the soil. Grass may be seeded the following spring, altho success sometimes follows seeding as soon as the ground has cooled from the fire. One of the mixtures just recommended for seeding on open land may be used, choosing for the more fertile soil a mixture in which bluegrass and timothy predominate, and for the less fertile soil a mixture made up largely of orchard grass and redtop but including small quantities of bluegrass and timothy.

Q.—How may timber land in the Ozark region be converted into pasture? A.—Cut out the undergrowth and small stuff and deaden much of the timber so that it will not shade the grass. If the soil can be loosened with a heavy drag harrow or bull-tongue plow before seeding, the grass will succeed much better, altho a good stand will usually come in on land too rough for this treatment if the soil is fairly fertile and the grass is not pastured too early. Any mixture of pasture grasses, including bluegrass, suitable for open land of a similar fertility may be used provided most of the trees are removed in order to favor the bluegrass—a plant which does not thrive in dense shade. But because of the possibility of leaving too much shade, it would be advisable in the beginning to let orchard grass—a shade resistant plant—predominate in the mixture, and from time to time cut out the trees until finally a condition more favorable for bluegrass is reached. Sometimes the seeding may be made cheaply by feeding livestock at various places over the pasture, with hay which contains seed of the grasses desired. But the initial stand secured in this way is usually thin and unthrifty, due to the poor quality of the seed; and moreover, noxious weeds are liable to be introduced with the hay.

Q. How may the sprouts be controlled on cut-over land and timber land while the pasture is developing? A.—On rough, stony land, where many trees are standing, the cheapest and most practicable means of controlling sprouts is to pasture them with goats. But if the farmer is unwilling to handle these animals, the sprouts may be destroyed by cutting in July or August, when drouth will prevent a renewed growth; this being of course a laborious and expensive process. A mower or sprout-killer may be used to good advantage when the sprouts are in full leaf, on fairly level land where the high stumps and trees are not too numerous. The sprout-killer deadens the sprouts by tearing off their leaves. It is said to be a very efficient implement.

Usually, reasonable attention to the sprouts during two or three seasons will so reduce their number that they will no longer greatly hinder the growth of the grass and may thereafter be held in check by occasional cuttings. When persistently checked they eventually disappear. Sometimes the sprouts are killed before the pasture is seeded, by cultivating corn on the land for two or three seasons; this being practicable only on the more fertile and level open land where cultural implements can be used.

On cut-over land or timber land naturally capable of producing grass, the control of sprouts is virtually the condition upon which the growth of pasturage depends.

Q.—What are the varieties of bluegrass and how do they differ? A.—Kentucky bluegrass (*Poa pratensis*), also known as June grass, is of course the most important and best known variety. Canada bluegrass (*Poa compressa*), also known as Virginia bluegrass, flat-stem bluegrass, and wiregrass, ranks next. The plants of Kentucky bluegrass and Canada bluegrass can easily be distinguished by the somewhat flattened stems and paler herbage of the latter variety. However, the seed of the two varieties are very closely alike, and bcause Canada bluegrass seed is cheaper, it has been much used to adulterate Kentucky bluegrass. But by a careful examination the Kentucky bluegrass seed is found to have more prominent veins than the other variety, and usually a paler color.

Although Canada bluegrass is grown under about the same climatic conditions as Kentucky bluegrass, it is more drouth-resistant and has the ability to thrive on poor soils where the Kentucky variety will scarcely grow. But under more favorable conditions of soil and season, it will not compare favorably with Kentucky bluegrass.

Texas bluegrass (*Poa arachnifera*) is a variety common to the southwest. In a general way it is similar to Kentucky bluegrass, although larger, coarser and more bunchy in habit. It is not aggressive and in time is crowded out by other grasses. This weakness, together with the high cost of the seed, has prevented an extensive use of the Texas variety.

Q.—What is English bluegrass? A.—English bluegrass (*Festuca elatior*), properly called meadow fescue, is not related to the other varieties and can readily be distinguished from them by a glance at its narrow head. It is well known in some parts of southwest Missouri, particularly Henry and St. Clair counties, where it is grown primarily for seed, altho valued also for hay and pasturage. A seed crop usually lasts three or four years, altho it will stand pasturing a much longer time.

English bluegrass is adapted to about the same range of soil types as timothy, but perhaps its favorite soil is one which is rich and moist or even wet. For its most successful growth the crop requires a thoroly prepared seedbed. The land should be plowed early in the season, after a thoro disking, and harrowed occasionally until seeding time in late August or early September. Sometimes, when the soil is unusually tough and heavy, it will be necessary to disk after plowing as well as before. The seed should be sown with a drill, at the rate of 8 to 10 pounds to the acre. The grass comes early in the spring and usually will stand light grazing until about April 1, altho under very favorable conditions the grazing may be continued a week or two longer. It ripens late in June; and after the seed crop is removed there usually is an abundant aftermath which furnishes good pasturage until late in the fall.

However, with all its special features, the so-called English bluegrass does not compare favorably with Kentucky bluegrass and Canada bluegrass as a pasture plant. These varieties are adapted to a wider range of soil conditions; they make a closer sod and are more aggressive and enduring.

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AGRICULTURAL EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 67 COLUMBIA, MISSOURI MARCH, 1919

Keep Sheep for Profit

D. A. Spencer

Question.—Can sheep be handled with profit on every farm? Answer.—Sheep cannot be handled with profit on every farm, but it is possible for them to return a good profit on most farms.

The requirements of a farm where sheep can be handled with profit are good drainage; plenty of fresh pasture; land that will produce clover, alfalfa, cowpeas, or soybeans; a good water supply; fences that will keep sheep out of growing crops and furnish two or three fields for frequent change of pasture; a shelter that will protect the flock from cold rains, winds, and storms; and an attendant who can give the flock interested and intelligent care. Crops of corn and oats can be used to very good advantage, but are not absolutely necessary. There are a few small areas in Missouri where sheep farming is not advisable because of the dangers of prowling dogs and wolves.

Q.—What advantages have sheep over other farm animals? A.—The first cost of a small flock of sheep is sufficiently moderate and returns on wool and lambs frequent enough so that almost every farmer can afford the investment.

Sheep will destroy weeds and underbrush better than other farm animals except goats.

The improvement of soil fertility by pasturing sheep is a phase of sheep raising that is of great importance. The flock will always be found on the hills or knolls during the hours of rest, so that the droppings are left in the parts of the field where they are most needed.

Except during the shearing and lambing season, sheep require less attention than any other class of live stock.

Q.—What are some of the drawbacks in sheep raising? *A.*—One of the greatest drawbacks to sheep raising is the stomach worm trouble. Lambs often die from this trouble and old sheep linger in a rundown condition which makes them very unprofitable. Most of the stomach worm trouble can be prevented, however, by the use of fresh pasture and by frequent change of pasture, provided the land is well drained.

Sheep are subject to trouble caused by maggots during hot summer months. This is most common, however, among fine wool sheep that have extremely wrinkled skin. Maggots are merely larva of the blowfly, which lays its eggs on the body of the sheep, especially in sores or soiled wool locks. These eggs hatch in twenty-four hours and the larva live on the body of the sheep, causing sores. When flies attack one sheep they keep at it until it succumbs, unless treatment is given. The application of a dilute coal tar dip is satisfactory.

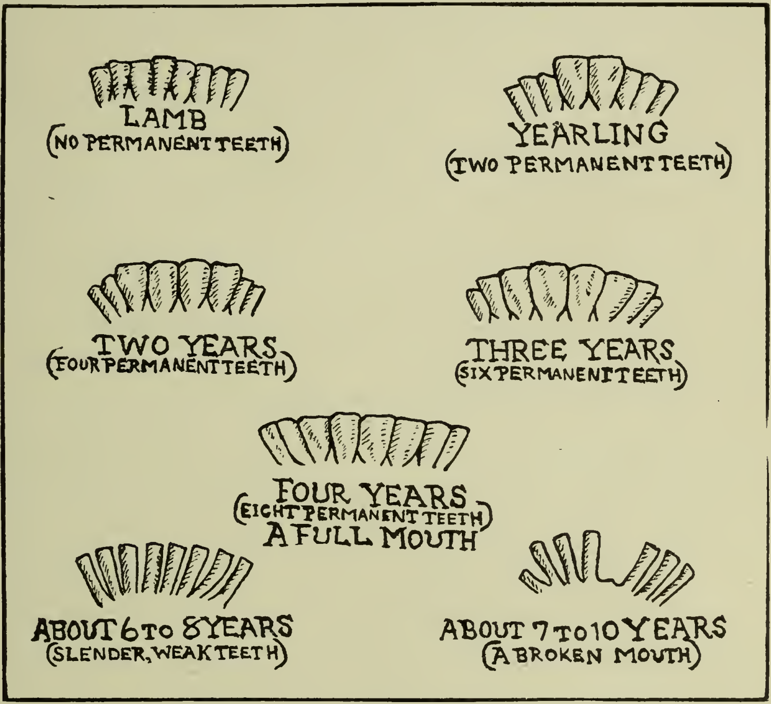
Sheep are frequently troubled with ticks. This trouble can easily be remedied by dipping the sheep in a coal tar solution and repeating the treatment in about ten days to kill all the young that hatch from the eggs after the first dipping.

A sick sheep is usually harder to treat successfully than a sick hog, cow or horse. This drawback need cause very little alarm, however, for with the exception of stomach worms sheep and goats are less susceptible to disease than other live stock.

Q.—Is special knowledge required in the care of sheep? *A.*—Some special knowledge is required for the most profitable success in the care of sheep. This knowledge can be acquired by actual experience in the management of small or moderate-sized flocks, and from more experienced farmers, sheep experts, and special sheep literature.

Q.—What kind of ewes should be kept? *A.*—Profitable breeding ewes are active, healthy and well grown. They should be uniform in size and breeding, straight in body lines, show capacity for feed and be well covered with dense fleeces of bright salable wool. It is especially important that they should be sound in mouth and milking organs.

Q.—What kind of a ram should be used? *A.*—The ram should be purebred, for on him depends in large part the improvement of the flock. He should be one to three years old. It is very important that he be masculine, vigorous and active. His body should be compact, broad, deep, full and massive, covered with firm flesh and placed on strong, straight legs. Full development of the back, loin, hindquarters and chest is of extreme importance in the ram that is to sire mutton lambs. It is also essential that he be evenly covered with a dense fleece. The ram should always be better than the average of the flock of ewes with which he is mated, and particularly strong where the majority of the ewes are weak.



Appearance of sheep's teeth at various ages

Q.—How should the flock be handled during the mating season? *A.*—It is well to have the ewes improving in condition of flesh at the time they are to be mated with the ram. They should not be kept in too high condition during the summer, for fat ewes often fail to breed. If they are in thrifty condition until about a week or two before the breeding season opens and then put on rich pasture they will be encouraged to breed readily. Most ewes will not breed till cool weather comes in the fall. If they do not come in heat readily then, and they are rather poor in flesh, a light feed of oats may prove helpful.

Q.—What is meant by flushing? *A.*—Flushing is the practice of stimulating ewes at breeding time with extra feed or a luxuriant pasture. This practice is advisable especially with ewes that have raised lambs and are in thin condition; for if they are well supplied with healthy blood, and gaining in weight, they will likely secrete more reproductive cells than they would in unthrifty condition. At any rate, healthy, thriving ewes at mating time are in proper condition to give the developing lamb a good start toward becoming a vigorous offspring at birth.

Q.—When should ewes be bred? A.—The time for breeding will depend on conditions for shelter and general facilities for lambing, as well as the feeding conditions and market demand. The period of pregnancy (from the date of conception till the date of lambing) is about 146 days. If lambs are to come in March and April the ewes must be bred in October and November. Shear around the rear parts of the ewes so the dung will not collect there. Dip the ewes and the ram if they have ticks or lice.

Q.—How many ewes should be allowed to each ram? A.—Use one ram to every 35 to 50 ewes. If a ram lamb must be used he may be capable of breeding only 10 or 15 ewes.

Q.—How long, during the breeding season, should the ram be allowed to remain with the ewes? A.—If the ewes breed freely they should all be bred in about six weeks after the ram was first turned with the flock. Keep a record of the time the ram is with the ewes.

Q.—How should the ram be handled during the breeding season? A.—To keep the ram vigorous feed him about one pound of grain each day during breeding season. Oats, or equal parts by weight of oats and corn makes a better grain feed for the ram than corn alone. He may be turned into a pen by himself and fed each night when the flock is put up. If he runs to pasture with the ewes during the day he will get plenty of exercise which will help to keep him in prime vigor.

Q.—Should the ram be kept away from the ewes during the winter? If so, why? A.—Pen the ram away from the ewes during the winter, for if he is allowed to remain with the ewes he will eat too much, become hard to manage and by bunting the ewes may sometimes cause abortions.

Q. How should the ewes be fed during the period of pregnancy? A.—Have the ewes gain about 15 to 25 pounds during the period of pregnancy. Supply winter pasture whenever possible. Utilize cheap roughages, such as corn stover and oat straw. When good pasture is not available supplement the cheap roughages with a daily allowance of one or two pounds per ewe of leguminous hay (the hay of clover, alfalfa, cowpeas or soybeans). During the last month of pregnancy feed one-fourth to one-half pound of grain a day for each ewe and increase the proportion of leguminous hay.

Q. What shelter should be provided? A.—Provide shelter that will protect the ewes against cold rains and storms. A well-roofed shed or barn placed on well-drained land, opening to the south, to admit plenty of sunlight, and so arranged as to be freely ventilated without direct drafts will serve as sufficient protection for sheep during a Missouri winter.

Q.—How should the ewe flock be divided during the winter? A.—To realize the greatest possible profit from the ewes it may be advisable to divide the flock into groups on the basis of condition, age, and time of lambing.

Q.—What of exercise for pregnant ewes? A.—Pregnant ewes require the equivalent of at least a mile's walk every day.

Q.—What are some good rations for pregnant ewes? A.—Each of the following rations contains approximately the amount of nutrients required daily for pregnant ewes weighing 125 to 150 pounds.

I
2 pounds corn silage
2½ pounds clover hay

II
2 pounds corn silage
2 pounds clover hay
½ pound shelled corn

III
2 pounds corn-stover (amount eaten)
2 pounds clover hay

IV
2 pounds corn silage
1 pound oat straw
¼ pound oil meal
½ pound shelled corn

The oil meal mentioned in ration IV could be of either linseed or cottonseed. One-half pound of oil meal per ewe per day will furnish sufficient protein for pregnant ewes. However, one-fourth pound oil meal with a selection of other feeds will be better than a ration containing a larger amount of oil meal.

If silage and pastures are not available beets or turnips, fed especially during the last month of pregnancy, will help wonderfully to avoid lambing troubles and insure a sufficient milk flow. Silage should be free from mold.

Timothy hay is not a good feed for sheep.

Corn fodder and corn silage should be supplemented with leguminous hay, oats, cottonseed meal or linseed meal. The reason for this is that fodder and silage, while very good feeds for sheep, do not contain sufficient protein (the muscle, bone and milk producing material) to insure satisfactory development of lambs before and after birth.

Q. What is necessary for successful management during the lambing season? A.—Lambing time is the shepherd's busiest season. The success of the year depends largely upon the percentage and vigor of lambs born and saved. Warm quarters are necessary in cold weather.

Q.—What is tht best place for a ewe and her new-born lamb? A.—A movable pen, four feet square, furnishes the best place for a ewe and her lamb until the lamb is one or two days old. The ewe is more sure to own her lambs, especially when she has twins, if she and her lambs are kept in this sort of a pen till they become thoroly attached. The ewe flock needs plenty of room (12 to 15 square feet of floor space each).

Q. How should the ewe be fed during the first few days after lambing? A.—Feed the ewe lightly (about one-half pound daily) on grain till her lamb is three or four days old. In addition furnish as much choice roughage as she will clean up readily.

Q.—When the ewe has trouble in giving birth to her lamb what should be done? A.—When lambs are coming rapidly the ewes should be watched day and night to avoid unnecessary losses. Occasionally a ewe will have difficulty in giving birth to her lamb, but it is unwise to give her help until she has tried for some time and appears to be unable to effect a delivery. When help is given, care should be exercised not to excite her more than is necessary. The essentials of aid are to see that the unborn lamb is in a normal position, with its legs so placed as not to hinder the progress of birth. When it is possible to draw on the lamb, do so as gently as possible and pull only at the time the ewe strains. As soon as the birth is about complete and it is possible for the lamb to breathe, remove the birth sack from the mouth and nostrils and blow into these parts to assist the new thing in getting its first breath. As soon as the danger of smothering is past, leave the pen and let the ewe clean and care for her lamb for a few minutes. If the lamb does not succeed in finding the teat in twenty or thirty minutes, give it some help by placing the mouth of the youngster to the teat of the mother. If it seems weak and indisposed to suck, place the teat in its mouth and squeeze some milk into it.

Q.—What harm may come of too much wool about the udder of the ewe at lambing time? A.—The shepherd should be very careful to see that there is no excess of wool about the udder of the ewe. If there is, these locks should be clipped away. This will make it easier for the lamb to find the teat, and will prevent the sucking of wool locks, which often causes wool balls in the stomach of the lamb and usually results in a stunted or dead lamb.

Q.—What feed and care are required during the suckling period? A.—Gradually increase the grain allowance so that the ewes will be getting about one pound daily for each 125 pound ewe in ten days or two weeks after lambing.

A satisfactory grain mixture is equal parts by weight of oats and corn when it is possible to furnish a daily allowance of two to four pounds of good clover or alfalfa hay. Rather heavy feeding is advisable until regular pasture season. Give the flock plenty of daily exercise.

Q.—How can lambs be grown with profit? A.—As soon as lambs are a week or ten days old they will begin to nibble at feed. If they are to be prepared for market at weaning time, or when they are three to five months old, encourage them to take as much grain as they will eat. Nursing lambs grow rapidly and make efficient use of grain. Supply the lambs with a creep, where they can eat grain and some choice clover or alfalfa hay by themselves.

Q.—What is a good grain mixture for nursing lambs? A.—A good grain mixture for nursing lambs is, by weight, corn 3 parts, oats 3 parts, and oil meal 1 part. Corn and oats should be ground during the first month. Increase the corn to 6 parts after the second month.

Q.—When should lambs be docked and castrated? A.—Dock and castrate the lambs when they are two or three weeks old.

Q.—What are the advantages of fresh pastures or forage crops for lambs? A.—Fresh pastures, or forage crops of clover, alfalfa, rape or rye, promote rapid growth and hold in check stomach worms.

Q.—Should the flock have free access to salt? A.—A constant supply of salt and good water should be furnished the entire flock thruout the year. It is especially important during the suckling period.

Q.—At what age should early spring lambs be marketed? A.—It is usually advisable to market early spring lambs at three to five months old, as lambs gain very little during the hot summer and are easily infested with stomach worms at that time. This plan saves feed and labor. Lamb receipts at the open markets are usually not as heavy at this time as in the fall, and prices may be more satisfactory.

Q.—In shipping lambs, what precautions should be observed? A.—When shipping avoid over-crowding, for many lambs may be trampled and suffocated. A common source of loss is overfeeding just before shipping. Many believe this will help reduce the shrink, but the truth of the matter is that it increases the shrink. When the lambs are loaded on the train and surrounded by new scenes and all sorts of excitement, their stomachs are sure to be upset. An overloaded stomach only increases the trouble. Just before shipment give a light, dry feed. The sheep will go to market and when unloaded will drink freely, and appear nearly as good as when they left the farm.

Q.—How must wool be handled to sell for its actual value? A.— Keep the fleeces free from burrs and other foreign material.

Q.—When and how should sheep be sheared? A.—Shear during late April or early May. Never shear when fleeces are wet. It is advisable to use a shearing machine. Avoid cutting the wool twice.

Q.—What of foreign substances in wool? A.—A clean, well swept floor is needed. Keep the fleeces clean and remove all dung locks. Tie them up in single fleeces, flesh side out. Use a wool box or roll the fleece up on a clean floor.

Q.—What kind of twine and how much should be used? A.— Glazed or paper wool twine are preferred by wool dealers and manufacturers. Never use binder twine as its fibers become mixed with the wool and reduce its value. Never use more twine on a fleece than is necessary. It will usually be possible to bind a fleece securely by two bands in each direction.

Q.—How should the wool be stored? A.—Store the wool immediately in wool sacks and keep in a clean dry place. Never place it on a floor strewn with chaff, straw or litter of any kind.

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AGRICULTURAL EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 68 COLUMBIA, MISSOURI MARCH, 1919

Country Roads

E. J. McCaustland

Question.—What are some of the advantages of good roads? Answer.—Good roads promote self-respect in a community. They make possible social intercourse. They bring the benefits of churches and schools within the reach of all. They help to keep the boys on the farm. They cheapen the cost of transportation of farm products to the markets and thus add to the farm profits. They add to the value of farm lands much more than they cost. They mark the degree of civilization of the rural community.

Q.—Into what three general classes, as regards construction, may roads be divided? A.—Dirt roads, various kinds of macadams, and pavements such as brick, concrete, asphalt, etc.

Q.—What should determine the kind of material to be used in road construction in Missouri? A.—The amount of traffic measured in tons, the size of the individual loads, the kinds of vehicles used for transportation purposes, the provision made for maintenance, the cost of available materials, and the amount of technical skill necessary in using such materials.

Q.—What are some of the materials or combinations of materials which might enter into the construction of country roads in Missouri? A.—For temporary roads, earth, shale, slate, chert, gravel and rock, or sand mixed with clay or gumbo. For heavy traffic on thru routes pavements may be required, but these are not ordinarily classed as "country roads."

Q.—In road building, what is included under the word "construction"? A.—Everything, beginning with clearing and grubbing, following with grading and ditching, and including the placing of culverts, and the final road surfacing.

Q.—What are some of the things which determine the cost of road construction? A.—Cost of right of way; cost of clearing and grubbing; amount and kind of material to be excavated and amount of filling to be done; amount of ditching for surface drainage and tiling for sub-drainage; number and size of stream crossings necessitating culverts or bridges; cost of securing and placing material.

Q.—What, in their order, are the three principal divisions of actual road making? A.—Location, construction, and maintenance. In planning a road it is necessary that we take into consideration all three of these steps, since proper location affects the cost of construction and may materially reduce cost of maintenance.

Q.—What are some of the things to be considered in locating a road? A.—Easy grades, good drainage, exposure to sunshine, elimination of culverts and bridges by avoiding unnecessary creek crossings, directness and the number of farms to be served for a given length of road. Whenever possible to avoid it, a good location should not be rejected merely because a certain roadway has been in use for some time. If the location of a used road is bad it should be changed if possible. In relocating roads avoid railroad crossings at grades.

Q.—Is the location of a road more difficult in a level or hilly country, and why? A.—There is not much difference, but it is somewhat more difficult in hilly country where a small change in alignment makes greater changes in grades. Level locations are usually difficult to drain properly, and hilly locations are likely to suffer from washouts. The location of a road is no job for an amateur or a mere surveyor. Money will be saved by employing a skilled highway engineer in this important step of road making. The location of a road is the most permanent thing about it.

Q.—What is meant by the term "grade" as used in road work? A.—The rise or fall in vertical feet for each 100 feet in horizontal length of road, usually expressed as a percentage. Thus, a 5 per cent grade means that the road rises or falls 5 feet for each 100 feet along its center line.

Q.—How does grade affect the size of load that can be handled on a smooth hard road? A.—It has been figured that on a smooth, country road the load that one horse could pull on a level would require two or a 5 per cent grade, three on a 10 per cent grade, and four on a 15 per cent grade.

Q.—Where it is possible to avoid heavy grades, what should be the maximum? A.—Engineers usually figure a 6 percent grade as a maximum, but at times it is impossible to avoid greater steepness.

Q.—What are surface drains? A.—Any open ditch such as occurs along roadways. Open culverts may form part of a surface drainage system.

Q.—How should the work of surface drainage be done? A.—Round up and keep smooth the road surface. Keep side ditches open and not too deep, but with ample fall. The less the grade (steepness) of the side ditches, the greater must be their width and depth to carry the same amount of water. At the top of deep cuts on roadways make shallow ditches to prevent water flowing down the slopes; and at the bottom of these slopes keep ditches open to carry away whatever water falls upon them.

Q.—What are some of the common mistakes in surface drainage as seen on Missouri roads? A.—Lack of crown on roadway and lack of smoothness of road surface. Side ditches are frequently much deeper than necessary, but obstructions prevent the water which falls on the surface from reaching them. Culverts are frequently too small, and lack of proper outlets for side ditches is common.

Q. What general rules should apply to the material, location and construction of culverts? A.—Use only durable material, such as concrete, brick, stone, vitrified pipe or cast-iron pipes. Avoid wood. Locate culvert in natural waterway, and as nearly at right angles across the roadway as possible. Allow ample capacity to carry flood waters. Construction should be supervised by a skilled workman. A rough surface on the inside of a culvert will materially reduce its capacity to carry away flood waters.

Q.—What is the proper treatment of wet-weather springs or spouty places in a road? A.—Under drainage by means of tiling or by open ditches filled with broken stone or gravel. Cut off underground flow before it reaches the roadway by side ditches, if possible.

Q.—Likening road construction to house building, what should every road have? A.—A good roof, a dry cellar, and a solid foundation. The foundation of a road should be kept solid by thoro drainage and the surface should be rounded, smooth and compact in order to shed the water from rains or melting snows.

Q. What are some of the tools ordinarily required for road work? A.—For grading purposes, plows, scrapers, axes, shovels and road machines. For concrete culverts, carpenter tools to build forms, and wagons to haul sand, gravel and stone. For road surfacing, dump wagons for gravel or broken stone, shovels and rakes to spread the material and a light roller for compacting. Special tools and machinery for brick or concrete paving or for road oiling.

Q.—Upon what does the kind of tools required depend? *A.*—The class of work to be done, its extent, and the financial ability of the community. Small jobs will not justify great expenditures for tools.

Q.—How should road grading be done? *A.*—If the work is light and the country fairly level, road machines are satisfactory. Deep cuts and fills require wheeled scrapers or dump wagons. Finishing of roadway should be carefully done and for this purpose some form of road machine is needed.

Q.—What is a common mistake in grading as seen on many dirt roads in Misouri? *A.*—The use of the small scoop or "slip" scraper. By dragging surface soil, full of organic matter, to the center of the roadway this scraper does more harm than good.

Q.—What are some of the objections to this method of grading? *A.*—It is difficult to finish the grading to an even line and cross section that will insure the prompt run off of the rain falling on the surface. Organic matter such as grass or weeds in a roadway will decay and develop a rut which may grow and ruin the road.

Q.—What are the steps in earth road building? *A.*—Grading, draining, and shaping the ditches and roadbed. (Ask Engineering Experiment Station, Columbia, Missouri, for bulletin on "Earth Roads and the Oiling of Roads".)

Q.—What is the approximate cost, per mile, of crowning and smoothing earth roads in Missouri, using grader and drag? *A.*—At the present time (1919) it will vary from $30 to $80 per mile, depending upon the amount of dirt to be moved and upon other conditions such as type of soil, etc.

Q.—Does the above take into consideration cost of cuts and fills? *A.*—Not if they exceed a few inches in depth. Cuts and fills in earth may be estimated at about 12c per cubic yard if the haul does not exceed 150 feet.

Q.—In grading a road so as to provide surface drainage, how much dirt should be moved? *A.*—On the level only so much as is necessary to raise the roadway above the surrounding land and open the ditches. In hilly country, deep cuts thru hills should have proper side ditches, and the fills shoul be protected from washing by ditches.

Q.—Why is moving more dirt undesirable? *A.*—Whenever dirt is moved, time is required for it to settle and pack. The larger the pile of dirt the more time it takes for it to compact. A team will draw from two to three times as much over a firm roadbed as over loose dirt. Shallow fills pack quickly under traffic as compared with the deeper ones.

Q. At what time of year should this work be done, and why? *A.*—On dirt roads in spring or mid-summer only. Never late in the fall because the earth will not be thoroly compacted before the fall rains and may become impassible in the winter thaws.

Q.—Is creek gravel a satisfactory road building material? *A.*—Yes, if free from decayed vegetation.

Q.—Which is more desirable, clean gravel or gravel having a filler? What is a filler? *A.*—Gravel with a "filler" is best. By this is meant a small amount of certain kinds of clay similar to the shales. Too much clay must be avoided as it may serve as a lubricator and thus prevent packing. Sometimes gravel contains enough soft stones that will break up under traffic and form a sort of cementing material.

Q.—What size of gravel is to be preferred and how is uniformity to be secured? *A.*—Gravel should not be larger than two inches or smaller than one-fourth inch. Different sizes may be separated by screening or forking, but a mixture of gravel of different sizes is desirable. The smaller particles will fill the spaces between the larger, giving a more compact roadway.

Q.—How should the gravel be applied and treated? *A.*—It should be spread on a solidly rolled sub-grade in a layer not more than 4 inches in depth and rolled with a 5 ton roller. The top layer of two or four inches (depending upon whether the whole is to be 6 or 8 inches in depth) should then be placed and rolled. If the traffic is depended upon to compact the roadway, the full depth may be spread on at one time but this is not a good practice.

Q.—In placing the gravel, what provision should be made to prevent it from working to the sides of the road? *A.*—In grading for foundation, leave low "shoulders" of earth as sides to retail gravel. Also distribute gravel in the center of roadway first and roll toward sides.

Q.—What is the approximate cost per mile of placing the gravel on a 10 *foot road?* *A.*—For a depth of 8 inches and an average haul of gravel of 1½ miles, from $1200 to $1500. (1919.)

Q.—In planning for the construction of rock roads what should always be the first step? A.—Find out whether suitable material can be had at reasonable cost. (Write to Engineering Experiment Station, Columbia, Missouri, for Bulletin on "Tests of Road Materials of Missouri".)

Q.—Describe a cheap and efficient implement for maintaining earth roads? A.—The King Split-Log drag is a road drag made of a split log, and originated by Mr. D. Ward King of Maitland, Missouri. Mr. King explains the construction as follows: "Take the two halves of a split log, ten or twelve inches thick and seven to nine feet long. Set the halves flat sides to the front, fasten thirty inches apart with strong stakes, the ends of which are wedged in two-inch auger holes, bored thru the slabs. Put a solid platform on the stakes for the driver to stand on. The hitch is made of strong wire or chain, the long end fastened to stake over the top of the front slab, the short end should be put thru a hole in center of the slab and near the end to prevent the back slab tilting forward. Face four or five feet of the ditch end of the front slab with iron. An old wagon tire, worn share of road grader, or any piece of flat steel will answer for this purpose."

Q.—When and how should a drag of this kind be used? A.—When roads are begining to dry up after rains. The drag is pulled at an approximate angle of 45° to the road so as to scrape a small amount of earth toward the middle to replace that which is worn and washed away. The operator will become expert in riding on the implement and shifting his weight along its length to increase or decrease the angle, when necessary.

Q.—Does the continued use of a drag actually have a tendency to harden the surface of the road? A.—Yes, it packs the soil and tends to make it impervious to water.

Q.—In addition to moving dirt, what other purpose does the drag serve? A.—In passing over ruts and puddles of water the drag crowds the water off the traveled way and fills the depressions with earth.

Q.—What, in brief, is the law providing for special road work in Missouri? A.—(a) Township boards in the counties operating under township organizations, may organize in whole or in part as special road districts on petition signed by the owners of a majority of the land in these districts, asking for such organization. The township board will then appoint from the landowners in the district, three commissioners who shall organize by electing one of themselves as president, one vice-president and one secretary. The township treasurer will act as treasurer of the board.

These commisioners shall fix the valuation of the land in the district, and estimate the cost of road work and distribute such cost to the land within the district. After this is done the landowners are called upon to vote on the proposition of construction, each owner having as many votes as he owns acres of land. They also are privileged to vote upon the kind of material to be used in construction and the methods of payment. If the project fails to pass, the question cannot come up again for a period of two years. If it passes, the commissioners can let the work of construction by contract.

(b) Special road districts may be organized from territory not exceeding 8 miles square wherein is located any city, town or village containing less than one hundred thousand inhabitants, except in counties under township organization (provided for in (a), or in counties containing more than fifty thousand inhabitants and lying adjacent to any city of the state containing more than three hundred thousand inhabitants.

(c) Counties not under township organization may, thru the county courts, divide the county into road districts which may be of any dimensions deemed necessary or advisable, except that they shall contain at least 640 acres of contiguous territory. For the improvement of roads in this district the county court appoints commissioners who shall organize and who are given power to levy taxes on the property taxable in the district for the construction of roads. The commissioners also are authorized to issue bonds to bear interest not exceeding 6 per cent per annum and to become due in not exceeding 15 annual installments, the first of which shall become due not later than two years after the date of such bonds.

Q.—What is required in the formation of a Special Benefit Assessment district? A.—When fifty qualified voters, resident tax payers of any proposed special road district shall file a petition with the county court, asking a vote of the people on the organization of such districts, the court shall give notice of election thru the press and have ballots prepared and an election called. If the majority of the votes cast be in favor of the adoption of the law, the county court shall make an order of record declaring the road district formed. The Mayor and members of the City Council of any city or town within the special road district thus organized, together with the members of the county court, shall then adopt the provisions of the law and appoint a board of commissioners of three persons to carry out the intent of the law.

This board of commissioners shall have complete control over the public highways within the district outside the corporate limits of any city or village therein. They may purchase an outfit to do the road work themselves, or they may let the work by contract. The board may repair, grade and improve to the distance of fifteen miles from any line of such special district of any highway outside such district, if the same be a prolongation of a highway in said district and if the inhabitants interested in such improvements or the county court or both will assist in contribution of money or work in making such improvements. Funds are provided by the county tax for road purposes on all lands within the district and in addition one-half of all funds collected for dramshop, pool and billiard table licenses.

Q.—What of issuing bonds for road construction or maintenance in Missouri? A.—The special road district commissioners (referred to in (b) and (c) in answer to a preceding question are authorized to issue serial bonds to bear not more than 6 per cent interest per annum and to run not more than fifteen years, the first of which shall become due not later than two years after the date of said bonds.

County courts may issue bonds in an amount, including existing indebtedness, not exceeding 10 per cent of the assessed valuation of such county. Such bonds shall bear interest not exceeding 5 per cent per annum, and shall become due and payable at the discretion of the county court not exceeding twenty years from date of issue. Such action of the court, however, requires a submission of the proposition to the voters and at least two-thirds of the qualified voters must support the issue.

Q.—Is it possible for county courts to aid special road projects within the county, such as cutting down hills, making expensive fills or putting in permanent culverts, by putting up dollar for dollar (or even smaller amounts) to offset money donated by communities or groups of individuals? A.—Yes, when citizens along any public road subscribe a sum not less than twenty-five dollars for grading, graveling or otherwise improving such road, the county court may appropriate a like amount.

Q.—Generally speaking, has road work in Missouri been as well managed as other public work? A.—No. Projects have been too narrowly limited to localities, resulting in fragmentary effort. Skilled location and supervision of construction have been generally lacking.

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University of Missouri - College of Agriculture and the United States
Department of Agriculture Cooperating
A. J. Meyer, Director Agricultural Extension Service

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Farm Buildings for Missouri

F. A. Meckel

The buildings on a farm make up one of the most important parts of the equipment. Any farm may be, and is, judged by the quality and arrangement as well as the appearance of the buildings. Poor, ill-kept buildings denote slovenliness and poverty, while good, well-kept buildings are a sign of prosperity and thrift.

Warm and comfortable buildings are necessary for the profitable raising of live stock; and adequate buildings must be provided for the storage of expensive crops, or there will be undue waste and loss.

Farm buildings are an important part of the farm, and should not be built haphazardly, but they should be carefully planned, with four chief points always in mind. These are: (1) Sanitation, (2) permanence, (3) location, and (4) economy in construction.

1. **Sanitation.**—This is a very important item for consideration, and there is a great need for more sanitary conditions in many farm buildings. The greatest germicide known is sunlight, and the more sunlight which enters a building the more sanitary it will be. Tuberculosis and hog cholera flourish in dark, damp, poorly drained and ventilated buildings. Sunlight makes a building lighter, warmer, and more dry and pleasant for live stock and for the man who does the work in the barn.

All buildings should have warm, dry floors, and these should be easily cleaned. Concrete is perhaps the ideal flooring material, for it is quickly and easily cleaned, and if properly laid and surfaced it will be neither damp nor slippery. Another advantage of a concrete floor is that it is non-absorbent, and does not provide breeding places for disease-breeding bacteria.

2. **Permanence.**—The advantages of permanent farm buildings are self-evident. Because of the expense of buildings, they should be constructed to last as long as possible, if they are to return money on the investment. Some of the factors which have a direct bearing on the permanence of farm buildings are, quality of materials entering into the construction, depth of foundation, care given to the building, and whether or not parts exposed to the elements are protected with a coat of good paint. Paint adds not only to the life of any building, but to the appearance as well.

3. **Location.**—This problem is of the greatest importance from a time and labor-saving standpoint. Different problems are presented on different farms; so it is impossible to lay down any hard and fast rules for locating farm buildings. Local conditions, such as natural drainage or slope will affect the location of buildings to a great extent, but perhaps the following suggestions may be found helpful:

1. The farmstead should be conveniently located with respect to the fields.
2. The farmstead should be near an improved road.
3. The barnyards and lots should be well drained, either by natural drainage or tiles.
4. Eave troughs emptying into drains or cisterns will eliminate much mud in barnyards.
5. An exposed hill is undesirable, but a south slope is to be desired.
6. A timber windbreak will prove valuable on the north and west of the farmstead.
7. The buildings should be grouped around a central courtyard.
8. The corncrib and granary should be convenient to the barn and hog houses.
9. A water supply must be available. Running water in house, barns and yards is a great convenience.
10. Barnyards should not face the house or road.
11. The barn and yards should be 150 to 200 feet from the house, and not in the direction of the prevailing winds.
12. The house should be set well back from the road to avoid the dust.
13. The house should command a view of the barn door, the front entrance from the door, and the central courtyard.
14. The shop and implement shed should be handy to both house and barns.
15. The poultry house may be nearer the house than the other buildings, but should be so placed, if possible, that the chickens will not overrun the yard.

16. The planting of shrubs in corners improves the appearance of the farmstead.

17. Good fences are to be advocated.

18. All buildings and fences should be kept painted and in good repair at all times.

19. Concrete walks from road to house and from the barns to the house will eliminate the tracking of dirt into the house.

It will not be possible to include all of these suggestions in one farmstead, but as many as possible should be adopted. The Agricultural Extension Service will give assistance in the arrangement of farm buildings, by correspondence or personal interview. When a special trip is made for this service, the man receiving the help will be expected to pay traveling expenses but there will be no charges for actual service.

4. **Economy.**—Cheapness of construction, if it affects the strength or durability, is poor economy. Strength and durability are essentials. There is some danger of making buildings too expensive. They should be in keeping with the value of the land and the stock and grain which they are to shelter. City bred farmers are apt to spend too much money on farm buildings. Often, a misguided wealthy man will invest a large amount in a farm building, hoping that it will be a model for his neighbors.. Buildings should, like all farm investments, pay interest on the investment. There is more danger, however, that the buildings will be too cheap than too expensive.

Missouri farmers are demanding better buildings. Due to increased prices, better care is being taken of all farm products. Live stock must have better shelter. Hay and grain must be carefully protected from the weather. Better living conditions for the family are necessary. In response to this demand for better buildings, the Agricultural Engineering Department has prepared this list of building plans. The plans listed do not cover the entire field of farm buildings, but new plans are being constantly added to this and persons who do not find what they want should apply to the Agricultural Extension Service for information.

A uniform charge of ten cents per sheet is made for plans, which covers only the cost of printing and material. The cost of each complete plan is given along with the description of the plan. When writing for plans, bear in mind the following:

1. Address the Agricultural Extension Service, University of Missouri, Columbia, Missouri.
2. Order by number.
3. Write your name and address plainly.
4. Send stamps, money order, or check with your order.

LIST OF PLANS

BARNS

No. C 3.—3 Sheets .... Price 30 cents

Barn for horses and cattle. Size, 36 by 50 feet. Capacity, 7 horses, 8 cows. Includes bull pen, box stall, corn crib, grain bin. Storage for 4 or 5 tons of hay overhead. Gambrel roof, self-supporting wing-joist frame. This is a good barn for a small farm.

No. C 39.—5 Sheets .... Price 50 cents

Basement barn for horses and cattle. Size, 34 by 64 feet. Capacity, 14 cows, 6 horses. Includes bull pen, calf pen. Storage for 50 tons of hay. Bins for corn and grain above. Horses in one end, cattle in the other. Shawver truss frame. Gambrel roof.

HORSE BARNS

No. C 4.—3 Sheets .... Price 30 cents

Size 32 by 50 feet. Capacity, 14 horses. Six single stalls, two double stalls, two box stalls, harness room, space for carriage. Hay storage for 40 tons, horses facing the outside walls, driveway thru center. Gambrel roof.

No. C 5.—4 Sheets .... Price 40 cents

Size, 36 by 52 feet with 14-foot shed at one end. Capacity, 15 horses. Includes seven single stalls, two double stalls, two box stalls, office, harness room, feed rooms. Storage above for 40 tons of hay. Plan shows two arrangements, with horses facing center, or facing outside walls. Gambrel roof.

DAIRY BARNS

No. C 41.—5 Sheets .... Price 50 cents

Size, 43 by 44 feet. Capacity, 16 cows. Includes calf pen, box stall. Feed room with silo opening into it. Hay storage above for 40 tons. Cows facing central feed alley. Details of floor construction. Gambrel roof, plank frame, self-supporting roof. A good barn for a small herd.

No. C 42.—5 Sheets .... Price 50 cents

Size, 34 by 72 feet. Capacity, 22 cows. Barn is divided into two parts. Cows are in one end. In other end are two box stalls, two calf pens, a bull pen, and a feed pen. Hay storage above for 65 tons. Cows face the central feed alley. Gambrel roof, plank frame, self-supporting roof. Details of floor construction.

No. C 1.—4 Sheets .... Price 40 cents

Size, 36 by 70 feet. Capacity, 27 cows. Includes bull pen, calf pen, feed room, box stall. Storage above for 85 tons of hay. Cows face central feed alley. Details of floor construction. Gambrel roof with plank self-supporting frame.

No. C 43.—5 Sheets .... Price 50 cents

Size, 34 by 91 feet. Capacity, 36 cows. Includes bull pen, box stall, calf pen. Hay storage above for 85 tons. Cows face central feed alley. Details of floor construction. Gambrel roof with plank self-supporting frame.

No. C 44.—5 Sheets .... Price 50 cents

Size, 34 by 101 feet. Capacity, 50 cows. Includes one box stall. Two silos and feed rooms on north end. Hay storage above for 95 tons. Cows face central feed alley. Gambrel roof with plank self-supporting frame. This is a milking barn for a large herd. Other buildings must be provided for the young stock.

No. C 20.—1 Sheet .... Price 10 cents

Construction of dairy barn floor. Shows proper size of stalls for different breeds of cows. Size of feed alley, trough gutter, etc. Three types of floor shown, concrete, concrete covered with board, and creosote blocks. Note: This sheet is included in each dairy barn plan.

SHEEP BARNS

No. C 6.—2 Sheets .... Price 20 cents

Sheep barn with hay storage above. Size, 32 by 40 feet. Capacity, 100 ewes. Includes shepherd's room, lambing room. Contains six movable feed racks 10 feet long. Hay storage for 30 tons. Dirt floor. Gambrel roof with plank self-supporting roof.

No. C 13.—2 Sheets .... Price 20 cents

Sheep feeding shed. Size, 30 by 80 feet. Capacity, 250 ewes. Movable feed racks placed in rows across the inside. Feed racks built along the east, west, and north walls, south side open. Shepherd's room on north side. Scissors truss for roof supports. Prepared roofing.

BEEF CATTLE BARNS

No. C 18.—1 Sheet .... Price 10 cents

Shelter and feeding shed. Size, 20 by 32 feet. (May be built as long as desired) South side open. Feed manger along north side. Sliding doors 8 feet wide at each end for driving thru with feed.

No. C 21.—2 Sheets .... Price 20 cents

Hay barn and feeding shed. Size, hay barn, 20 by 48 feet; shed, 18 by 48 feet. Room to feed one car of steers. Storage for 35 tons of hay. Gable roofed hay barn with hay extending to the ground. Lean-to-cattle shed along south with south side open.

No. C 22.—3 Sheets .... Price 30 cents

Large cattle barn. Size, 58 by 66 feet. Hay barn, 30 by 40 feet in the center, with lean-to sheds 18 feet wide on the east, west, and south side. Storage for 50 tons of hay. South side of shed open. Large doors for driving thru with manure spreaders. Galvanized metal roof.

No. C 25.—4 Sheets .... Price 40 cents

Barn for purebred beef cattle. Size, 36 by 70 feet. Capacity, seven box stalls 10 by 12 feet, seven double tie stalls. Central feed alley with mangers on each side. Feed room and silo at one end. Hay storage above for 65 tons. Dirt floors in stalls, concrete in feed alley. Gambrel roof, with plank, self-supporting frame.

No. C 68.—4 Sheets .... Price 40 cents
Purebred cattle barn. A barn designed for the housing of purebred livestock. 36 by 72 feet. Has 14 tie stalls and 7 stalls for calves opposite. Feed room and bull pen.

No. C 72.—3 Sheets .... Price 30 cents
Sale barn and ring. Ring and barn for cattle and stock public sales.

FARM HOUSES

No. C 26.—3 Sheets .... Price 30 cents
Small, plainly built farm house. Size, 24 by 28 feet. Full two stories. Kitchen, dining room, living room, and bed room on first floor. Three bedrooms and bath upstairs. Basement divided into furnace room, laundry, coal room, and vegetable room.

No. C 40.—4 Sheets .... Price 40 cents
Size, 28 by 32 feet. Kitchen, combined living room and dining room, bed room and bath room on first floor. Two bed rooms and small sleeping porch above. Upstairs is cut by the low roof, making the bed rooms small. Basement is divided into laundry, vegetable room, coal room, and furnace room.

No. C 45.—3 Sheets .... Price 30 cents
Size 32 by 38 feet. This is a comfortable farm house with sufficient size to include many desirable features. Includes living room, dining room, bed room, kitchen, men's wash room on first floor. Four bed rooms and bath and sleeping porch on second boor. Basement divided into laundry, furnace room, vegetable and fruit storage room, and coal room.

No. B 60.—5 Sheets .... Price 50 cents
Small Tenant House. Size 18 by 20 feet. One story. Living and dining room combined. Platform porch, 14 by 6 feet. Designed for tenant cottage especially.

No. C 61.—5 Sheets .... Price 50 cents
Small Tenant House.. Size 20 by 28 feet. One story. Kitchen and dining room combined. Two bed rooms and a living room. Designed as a tenant house but may be used as a regular farm house. Has small stoop in front and a screened-in porch in the rear.

HOG HOUSES

No. C 2.—1 Sheet .... Price 10 cents
Half monitor roof hog house. Size, 24 by 50 feet. Capacity, 14 pens for sows. Feed alley in the center with pens 7 by 8 feet on either side. Windows in two rows. House to be set east and west. Concrete floor with drains beneath. Pen sloping toward the tile inlets.

No. C 36.—3 Sheets .... Price 30 cents
Long, narrow hog house. Size, 12 feet wide, and as long as desirable. Feed alley along north side with single row of pens. Feed rooms in addition 16 by 18 feet on the north side. Storage above for two tons of straw. Floors in pens of hollow clay blocks.

No. C 35.—3 Sheets .... Price 30 cents
Iowa Sunlit Hog House. Size 24 by 60 feet. Single pens 6 by 8

feet to accommodate 20 sows. Feed alley 8 feet wide in center. Continuous row of skylight windows on either side of peak of roof. Floor of concrete with clay blocks in pens. Walls made of clay blocks or concrete. A permanent hog house suitable to North Missouri.

No. C 58.—1 Sheet .... Price 10 cents

Movable Hog House. Mounted on skids or runners and designed for a colony house. Size 8 by 8 feet. Half monitor roof with two windows in front part of roof. Roof lifts up, and back wall will swing out.

No. C 59.—1 Sheet .... Price 10 cents

Movable Hog House. Mounted on runners and designed for a colony house. Size 8 by 8 feet. Both front and back may be opened. Roof is gable style, and one side is divided into two doors which will swing out.

SELF-FEEDERS FOR SWINE

No. B 14.—1 Sheet .... Price 10 cents

Small feeder for conditioner. Size, 2 feet, 8 inches high, 2 feet 6 inches wide and 2 feet 6 inches long. Hinged top to protect feed. Adjustable slide.

No. B 28.—1 Sheet .... Price 10 cents

Rack for feeding roughage such as clover or alfalfa. Size, 5 feet long, 3 feet 6 inches high, 3 feet wide.

No. B 29.—1 Sheet .... Price 10 cents

Feeder for tankage. Size, 3 feet long, 3 feet high and 1 foot wide. Accommodates 25 shoats. Cover to protect feed. Adjustable slide to regulate feed.

No. C 30.—1 Sheet .... Price 10 cents

Feeder for shelled corn. Size, 6 feet long, 4 feet high, and 3 feet wide. Hinged cover. Adjustable slide to regulate feed.

No. C 31.—1 Sheet .... Price 10 cents

Feeder for ear corn. Size, 6 feet long, 4 feet wide, 4 feet 6 inches high. Mounted on 4 by 4 inch skids. Has wide trough to hold ear corn. Adjustable slide. Wide, over-hanging cover.

POULTRY HOUSES

No. C 65.—1 Sheet .... Price 10 cents

Missouri Poultry House. 20 by 20 feet. Will accommodate from 125 to 175 hens. Write the Agricultural Experiment Station, Columbia, Mo. for free circulars Nos. 75 and 93 in connection with this plan for building.

CORN CRIBS

No. C 24.—1 Sheet .... Price 10 cents

Double crib. Size, 28 feet wide, 32 feet long. Cribs 8 feet wide. Driveway 12 feet wide. Capacity 3,000 bushels corn. Space to store machinery above drive-way. Gable roof. Solid concrete floor.

No. C 23.—1 Sheet .... Price 10 cents
Single crib. Size, 10 feet wide, 30 feet long. Capacity 1,650 bushels corn. Solid concrete floor, shed roof.

No. C 54.—1 Sheet .... Price 10 cents
Rat proofing a corn crib. Plan shows method of constructing concrete floor and screening crib to make it rat proof.

No. C 55.—1 Sheet .... Price 10 cents
Small farm granary. Size, 18 feet long, 12 feet wide, and 10 feet high. Capacity, 1,200 bushels. Concrete floor, steel tie rods to prevent bulging. One door.

SILOS

No. C 7.—3 Sheets .... Price 30 cents
Concrete solid wall silo. Size, 16 feet in diameter. Plans given for making wooden forms, door frames, and scaffold work. Construction of foundation. How forms are assembled and raised. Complete directions for mixing concrete and reinforcing the silo are also given.

No. C 8.—3 Sheets .... Price 30 cents
Concrete silo. Size, 14 feet in diameter. Plan same as No. C 7.

No. C 9.—3 Sheets .... Price 30 cents
Concrete silo. Size, 12 feet in diameter. Plan same as No. C 7.

No. C 10.—3 Sheets .... Price 30 cents
Concrete silo. Size, 10 feet in diameter. Plan same as No. C 7.

No. C 46.—1 Sheet .... Price 10 cents
Emergency eight-sided silo.
Size, 14 feet in diameter. Vertical 12-inch boards are held together by girths made by 2 by 6 inch pieces nailed together at corners. Girths are spaced 18 inches apart at the bottom and 2 feet 6 inches at the top. Interior is covered with heavy roofing paper. This is a cheap wooden silo which can be constructed on the farm.

No. C 47.—1 Sheet .... Price 10 cents
Emergency eight-sided silo. Size, 12 feet in diameter. Plans same as No. C 46.

No. C 48.—1 Sheet .... Price 10 cents
Wooden hoop silo. Size, 16 feet in diameter. Hoops are made of eight pieces of siding curved to form a circle and nailed together. Matched flooring is nailed vertically on the inside and outside of these hoops. Plan shows construction of hoops, bracing of wall, door frames, roof, etc.

No. C 49.—1 Sheet .... Price 10 cents
Wooden hoop silo. Size, 12 feet in diameter. Otherwise plan is same as No. C 48.

BARN FRAMES

No. C 33.—2 Sheets .... Price 20 cents
Plank barn frame. For gambrel roof barn 36 feet wide. Shows the

construction of a self-supporting roof, leaving the hay mow unobstructed. Plan shows cross section, end framing, side framing, and details.

No. C 34.—2 Sheets .... Price 20 cents
Shawver truss barn frame. For gambrel roof barn 36 feet in width. a self-supporting roof of very rigid construction. Plan shows cross-section, side and end framing, and details.

WATER TANKS

No. C 11.—1 Sheet .... Price 10 cents
Round stock tank. Size, 6 feet in diameter and 2 feet 6 inches deep. Plan shows the construction of forms, the amount and position of reinforcing, and the thickness of the walls.

No. C 12.—1 Sheet .... Price 10 cents
Rectangular stock tank. Size, 5 feet wide, 2 feet 6 inches deep, and as long as desirable. Construction of inside and outside forms, sub-base. Amount and position of reinforcing, thickness of walls.

No. C 37.—2 Sheets .... Price 20 cents
Elevated water storage tank. Size, 10 feet in diameter by 9 feet deep. Set on a concrete block foundation 10 feet above ground. Room beneath suitable for storing milk or cream. Plan shows complete construction details.

No. C 32.—1 Sheet .... Price 10 cents
Septic tank. Size, 6 feet long, 3 feet 6 inches wide and 4 feet deep. A simple sewage disposal system for a farm home which has running water. Concrete construction. Plan shows construction of forms, thickness of walls, and filter.

ICE HOUSES

No. C 38.—2 Sheets .... Price 20 cents
Small farm ice house of tight refrigerator construction. Size, 20 feet long, 14 feet wide and 15 feet high. Has a small milk-room in connection, which is cooled by air circulation. This ice house is well-built, with walls of triple thickness.

No. C 51.—2 Sheets .... Price 20 cents
Small farm ice house of cheap construction. Size, 16 feet long, 12 feet wide and 10 feet high. Has single 1-inch board wall supported by two by fours or poles set in the ground. For use only where ice and sawdust are plentiful.

CONCRETE FOR LIVESTOCK FARMS

No. C 17.—1 Sheet .... Price 10 cents
Dipping vat. Size, 40 feet long, 4 feet deep, width varies from 14 inches to 2 feet. Length of vat proper 16 feet. Concrete bottom and sides. Plan shows method of construction in full.

No. B 16.—1 Sheet .... Price 10 cents
Hog wallow. Size, 16 feet long, 10 feet wide, 18 inches deep. One

end has a roughened slope for hogs to enter. Walk and bottom of concrete 6 inches thick. Overflow pipe and tile drains.

No. C 52.—1 Sheet .... Price 10 cents
Concrete feeding floor for swine. Size, 32 feet by 24 feet. Accommodates 75 hogs weighing 200 lbs. Plans show construction of subbase, wall at sides, approach, and expansion joints.

No. C 19.—1 Sheet .... Price 10 cents
Concrete hog troughs. Plans show the construction of forms and reinforcing for different types of hog troughs.

No. B 57.—1 Sheet .... Price 10 cents
Small Concrete Stock Tank. Size, 6 by 2½ feet. Designed for use where several tanks are to be placed in various locations as in bull pen, calf pen, hog lot, etc. Forms are collapsible and held with four iron rods. Removal of these will collapse form.

MISCELLANEOUS PLANS

No. C 27.—1 Sheet .... Price 10 cents
Machine shed. Size, 18 feet wide, 48 feet long. Simple shed with continuous sliding doors in front, dirt floor. A cheap, convenient shed.

No. B 15.—1 Sheet .... Price 10 cents
Gang mold for concrete fence posts. A home made wooden mold by which six posts can be made at once. Size of post, 7 feet long 3½ by 3½ inches at one end, and 5 by 5 inches at the other.

No. C 50.—1 Sheet .... Price 10 cents
Plans for a home-made lime spreader. Size, 7 feet long. Capacity, 1,000 pounds of limestone. Old mower wheels and shaft are used. Plan shows complete building details. Directions for building.

No. B 53.—1 Sheet .... Price 10 cents
V-shaped terrace drag. For grading up the Mangum terrace. Made of 2 by 12 inch plank 12 feet long with wing 6 feet long. Adjustable to different widths. Can be made on farm.

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Implement Shed. Half Monitor Roof. Size, 48 by 22 feet. Has concrete foundation extending two feet above ground. Can be made with open front or by placing track, four sliding doors may easily be installed.

No. C 62.—1 Sheet .... Price 10 cents
Concrete Culvert for farm road use. Shown as 24-inch culvert. Can be adapted to any size.

No. B 64.—1 Sheet .... Price 10 cents
Hog breeding crate. After model recommended by U. S. D. A.

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Bull Stocks. An outdoor stanchion designed to hold large animals for dehorning or other operations. Designed to lift the animal off the ground.

No. C 67.—1 Sheet .... Price 10 cents
Dehorning Chute. Corral and stocks combined for dehorning cattle in large numbers. Can also be used as a branding pen.

No. B 69.—1 Sheet .... Price 10 cents
Water Filter. Concrete filter for purifying water before it enters the cistern.

No. B 70.—1 Sheet .... Price 10 cents
Poultry Feeder. Self-feeder for poultry. Designed for the use of oyster shell, grit or conditioner and dry mash.

No. C 71.—2 Sheets .... Price 20 cents
Farm Shop Plan. Design of a shop for the farm. Shows the equipment placed such as a forge, anvil, drillpress and power equipment.

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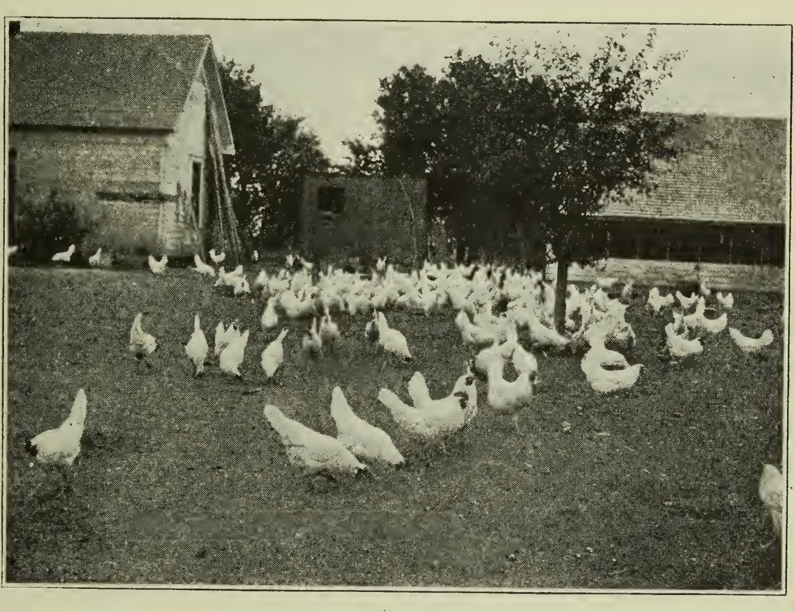
A. J. Meyer, Director

CIRCULAR 70 COLUMBIA, MISSOURI AUGUST, 1919

HOW TO CULL FARM HENS

By T. S. Townsley



A well-culled profitable flock.

Two-fifths of the Missouri farm hens fail to pay their feed bill. Unless a hen lays from 60 to 75 eggs a year she is being kept at a loss. High priced feeds make it vital that only good layers be kept. To rid the farms of low producers each flock owner should practice some method of culling.

One Missouri county reported that 38,329 low producing hens were culled from 858 farm flocks in the fall of 1918 with an estimated saving of more than $32,000 for feed. Proper culling reduces the feed bill but not the egg production.

IMPORTANCE OF VIGOR

Every poultry keeper understands that strong constitutional vigor and good health are necessary for high egg production. He also knows that the weaklings of the flock should be eliminated. The disposal of birds lacking vigor should be a continuous process in every poultry yard. This culling should begin at breeding time and should extend thruout the year.

Culling for vigor is fundamental. This alone, however, is not a sufficient test to eliminate all poor layers. Many robust hens in the very best of health are poor egg producers and seriously handicap poultry profits.

In the final analysis the performance of the hen on the nest is the criterion that proves her value. For satisfactory culling some means of arriving at the relative number of eggs produced is necessary.

METHODS OF CULLING

The Trap Nest.—The most accurate method of determining the value of the hen as a producer is by the use of the trap nest. This shows definitely which hens lay each day. Unfortunately a great majority of farm poultry keepers are not in position to use the trap nest on account of the time and labor involved, and some simpler means of judging the value of the hens is urgently needed.

Habits of the Hen.—The habits of the hen indicate to a certain extent her status as a producer. Any poultry keeper who has time to observe his birds closely can usually pick out the best layers. The highest producers are active, busy, friendly, and happy. They are the first off the roost at day-break and the last to retire at dusk. During the day they usually are found scratching for food or on the nest ready to lay. They frequently sing while they work. If handled, they are quiet and seldom squawk.

The poor layers are inclined to loaf and may be found in the houses or on the roosts a good share of the time. If caught they become very much excited and let forth vigorous cries of protest.

Where the birds are closely observed the foregoing points give a valuable clue to the laying tendency of the different hens. On the general farms, however, most persons do not get well enough acquainted with the hens to make much use of these indications.

A Simple Culling System Needed.—The general demand from the busy owner of the average farm flock is for some simple method of culling whereby, on a certain day, the entire flock can be gone over and the worth while hens be separated from the worthless ones. As a result of studies and observations, extending over a number of years, made by investigators and poultry keepers, such a system of culling has been evolved. The purpose of this circular is to outline the points and describe the method whereby any flock of hens may be systematically culled and the low producers be eliminated without previous observation.

A DEFINITE CULLING SYSTEM

The system of culling outlined in this circular is based upon the fact that nature stamps the hen with certain visible characteristics which indicate the traits and habits of the individual. As in the human family the hard working farm wife is easily distinguished from the social butterfly of the city, so in the hen family certain visible characters indicate whether a hen has been a high layer or a loafer. Anyone who studies the birds closely may easily recognize these differences.

CONSIDERATION OF AGE IN CULLING

Egg production decreases with age. The first laying year is the most productive period in the life of the flock. With the Plymouth Rocks, Rhode Island Reds, Wyandottes, Orpingtons and other birds of the heavier type, the number of eggs laid after the second laying year is usually not enough to pay for the feed. Birds of these breeds should not be kept longer than two laying years. With the lighter breeds the period of profitable production lasts one season longer and the best Leghorns, Minorcas, Anconas, and Campines, may be kept thru three laying years, but should be disposed of at the end of that period. As the laying year ends at molting time it is important that all two-year-old birds of the medium or heavy type and all three-year-old birds of the lighter type be sold each fall. There is no accurate method of judging the age of hens, so each year's hatch should be marked with toe punches, leg bands, wing bands or some other means of telling what year they were hatched.

TIME TO CULL

The ideal time to give the flock a complete culling is about the middle of the molting period. This will vary with the different flocks, but usually comes in August, September or October. The characters which distinguish good layers from poor ones are most evident between August first and November first. At this time the birds are being prepared for winter quarters and some reduction in numbers is usually desirable. The hens have finished the heavy season of production by this time and the poorer ones have stopped laying. The low producers will not lay during the fall and winter months and should be sold. Careful fall culling reduces the winter feed bill, but not the egg production.

ESTIMATING PRODUCTION OF PULLETS

Every well-developed, early hatched pullet in good health is a potential high record bird. Just as there is no method of judging the speed of a horse before he has been raced or of determining the butter-fat record of a heifer before she has freshened, so there is no accurate means of telling how many eggs the pullet will lay until she has been given a trial.

As a rule most pullets that start laying before cold weather will lay at least enough eggs to pay for their feed during their first laying season. All mature, vigorous pullets should be kept. Any weak, undersized, late hatched, or deformed pullets, should be culled out in the fall. Other methods of estimating the future egg production of pullets are inaccurate and their use is not advised.

THE REAL CULLING PROBLEM

The real problems in culling are found with hens that have finished one or two laying seasons. The general rule with pullets is to keep practically all, and with aged hens to dispose of all, but with all yearling hens and with two-year-old hens of the lighter breeds some should be sold and others kept. To cull hens of these ages every bird must be studied to determine her value. Nature has marked the poor producer and the poultry keepers should read nature's record.

ARRANGEMENTS FOR CULLING

To cull a flock systematically every bird must be handled. To accomplish this without causing undue excitement in the flock definite arrangements should be made for catching and handling the fowls. It is advisable as a test for the accuracy of culling that the culled hens be kept for at least a week and their egg production noted. Lots should be provided so that the good hens may be kept separated from the culls. For catching the birds a coop or crate open at one end so that the fowls may be driven through a small door in the hen house directly into the crate, is a great convenience. If this crate has an opening at the top so the birds may be easily lifted out an entire flock can be handled quickly and without much disturbance among the birds.

DOES THE CULLING SYSTEM WORK?

Directions for determining which hens should be disposed of were issued last fall by the University of Missouri Poultry Department. Under the leadership of the Poultry Specialists in the Extension Service of the State College of Agriculture co-operating with the United States Department of Agriculture and the county Farm Bureaus, these culling plans were extensively employed in about thirty-five Missouri counties. That the results secured were highly satisfactory is shown by the reports submitted by hundreds of poultry keepers and the great demand for culling demonstrations.

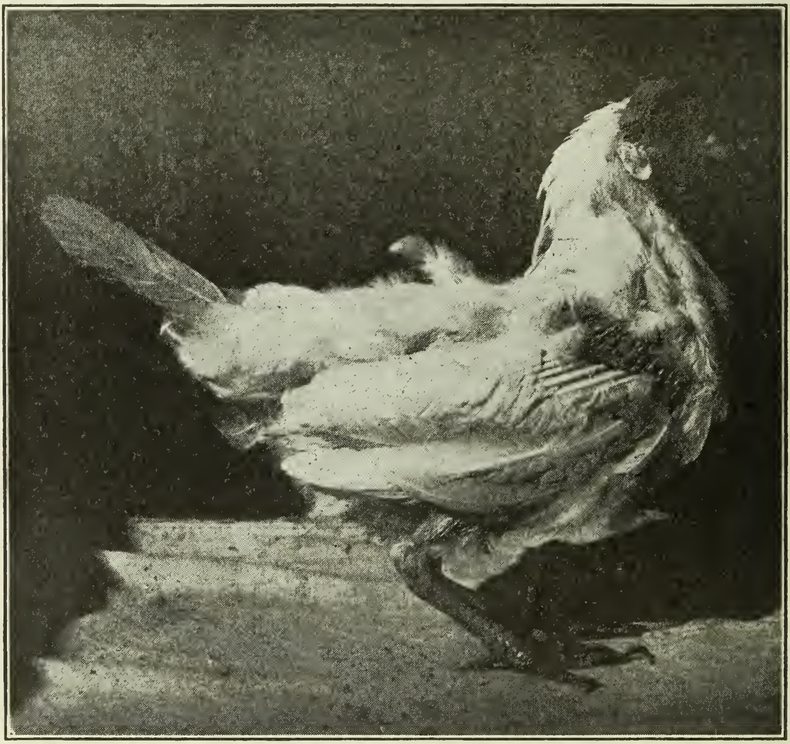
From the flock of 166 Rhode Island Reds owned by Mr. W. H. Orr of Clinton County, 70 hens showing the ear marks of loafers were removed. During the four days previous to culling Mr. Orr received an average of 34 eggs each day from the 166 hens. For the first six days after culling he received an average of 32 eggs each day from the 96 hens left.

The Home Demonstration Agent in Greene County reported that from 858 farm flocks culled by this system in her county, 38,329 low producing hens were sold. She estimated that $32,454.00 worth of feed which otherwise would have been wasted was saved by this campaign.

A Chicago poultry dealer who handles cars of live poultry from Missouri reported that several cars of live hens arrived in Chicago with no eggs in the coops. Ordinarily the free eggs in a car of hens furnishes a fine source of revenue to the dealers. Investigation by the Chicago firm showed that these hens were coming from counties where culling campaigns had been conducted and the farmers were selling only non-laying hens.

WHAT TIME OF MOLTING SHOWS

In systematic culling the date of molting is one of the important points to consider. The time that the hen molts shows whether she is a persistent layer or a quitter. When the hen molts she has finished her laying season. The good producer keeps on laying late into the fall until approaching winter forces her to stop and renew her coat of feathers. The poor producer exhausts her laying energy in the spring and starts molting in July, August or September. She has a greatly shortened laying season, but prolongs her molting period thruout several months. The early molter sheds slowly, while the late molter sheds quickly.

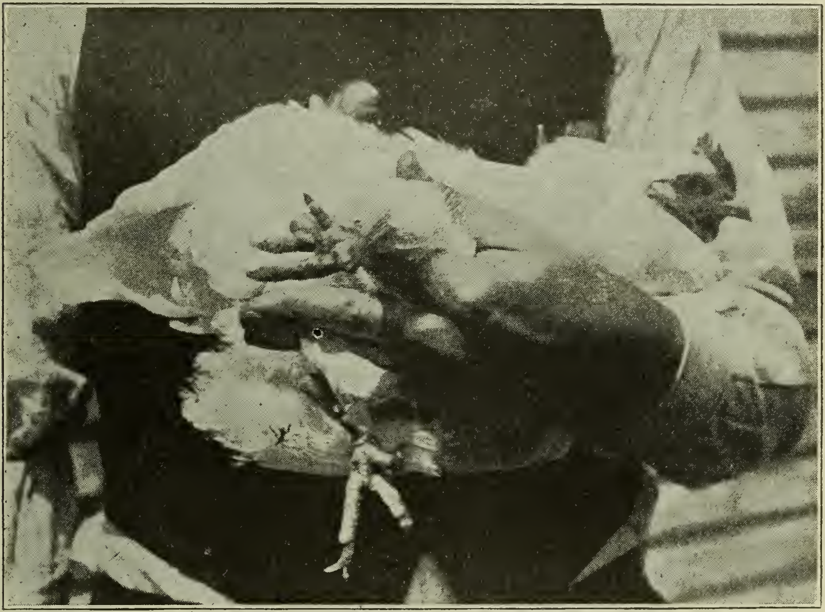


A hen in full molt.

Contrary to the opinion of many poultry keepers, the early molter is a poor layer. The contention that early molters make good winter layers is largely a fallacy. Trap nest records show that hens that molt early did not lay during the winter of their pullet year and will not as a rule lay profitably during any subsequent winter.

The average time of molting in the fall is influenced by feeding and general management, but the earliest molters in any flock can be marked as the poorest layers.

In handling the hens it is easy to determine the condition of molt. If the molt has started some feathers will be missing and the soft, tender, pin feathers will show prominently where new feathers are coming in. If the molt is completed the coat of feathers will be clean, fluffy and in excellent condition. If the molt is not started the coat will be dirty and ragged and the ends of the wing and tail feathers are likely to be worn and broken.



Proper position of the hen in culling.

In examining the condition of molt some allowance must be made for hens that have set and raised chickens, as they usually undergo a partial molt before resuming egg production. Hens of this type may easily be mistaken for early molters at culling time.

As a general rule all early molting hens should be sold, but it should be remembered that the time of molt is only one of the five ways in which nature distinguishes the good hen from the poor one and consideration should be given the other four points before the hen is discarded.

HOW TO HOLD A HEN

In handling a bird to study her definite characteristics she should be held in such a position that the different distinguishing points may be determined without danger of injury to the hen. If the operator is right handed the hen should be held in the left hand. To get a firm grip on the bird turn the palm of the left hand upward and spread the fingers to admit the legs of the hen, allowing the hen's body to rest in the palm of the hand with her right leg between the thumb and index finger and her left leg between the fourth and fifth fingers, and with her head and neck extending along the arm of the operator. In this position the hen rests easily and any part of her body may be examined without changing the hold.

PIGMENTATION OR BODY COLOR

Prominent yellow pigment in yellow skinned birds at culling time is a good indication of a poor egg record. This is especially evident in shanks and beaks and in ear lobes of birds belonging to the Mediterranean class. This character does not apply to Orpingtons or other white skinned breeds.

With Plymouth Rocks, Rhode Island Reds, Wyandottes, Leghorns and the other yellow skinned breeds, healthy, vigorous pullets have prominent yellow shanks and beaks before they start laying. During the laying season this color very largely disappears in the heavy producers. The best layers of the above mentioned breeds will show pale shanks and beaks at culling time.

Farmers who have been in the habit of selling their pale shanked birds each year have been selling their very best layers. The color of feed, and the kind and extent of range, as well as the vigor of the fowl have some influence on shank color. So the fact that the hen has pale shanks is not conclusive proof that she has a high egg record. On the other hand prominent yellow shanks, beak and ear lobes in a hen that has finished one or more laying seasons is a good indication of a loafer. Some exception must be made here for the hen that has set, as the yellow color is usually replaced in the body parts when the hen stops laying for a considerable period.

A little practice should enable any poultry keeper to distinguish between the high laying yearling or two-year-old hen of the yellow skinned breeds, and the poor layer of the same type, by the amount of pigment displayed in the visible parts of the body at culling time.

IMPORTANCE OF QUALITY

Quality of skin and bones is another mark which indicates the producing ability of the hen. The coarse bird is almost invariably a poor layer. High egg production is associated with a certain fineness of skin and quality of bone that may be readily distinguished.

Persons experienced in handling laying hens can tell very accurately, by the feel of the skin as soon as the bird is picked up, whether or not she is a good layer.

Judging the quality of skin and keel.

The skin of a high record bird is soft, thin, pliable and velvety to the touch. The skin of a poor producer is thick, rough, and dry, and has a texture which suggests parchment paper.

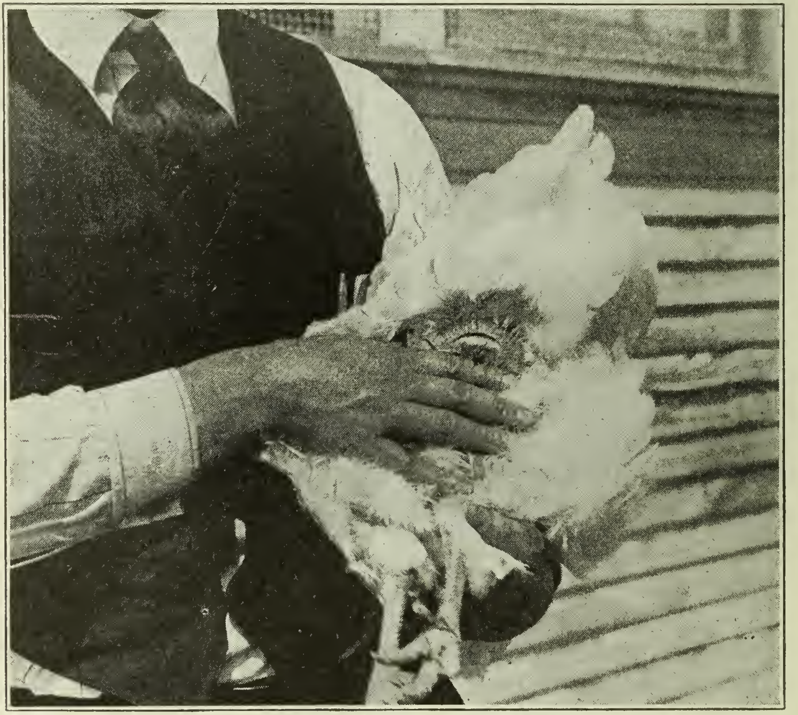
The quality of bone can be determined by examining the keel and pin bones. In a good producer the keel, or breast bone, is thin and smooth in texture. When examined between the thumb and finger the edge of the breast bone of a good producer has a knife-like appearance. In the poor producer the keel is coarse and rough with a thick blunt edge.

The ends of the pin bones of a high laying hen are thin, straight and flexible, while in the low producer they are thick, curved and unyielding.

After a few hens have been handled the various indications of quality become easily recognized. The determination of quality requires more skill than any of the other tests for producing ability, but when carefully applied this is one of the most accurate tests, as there are few exceptions to the rule that quality and productiveness go hand in hand.

BODY CAPACITY

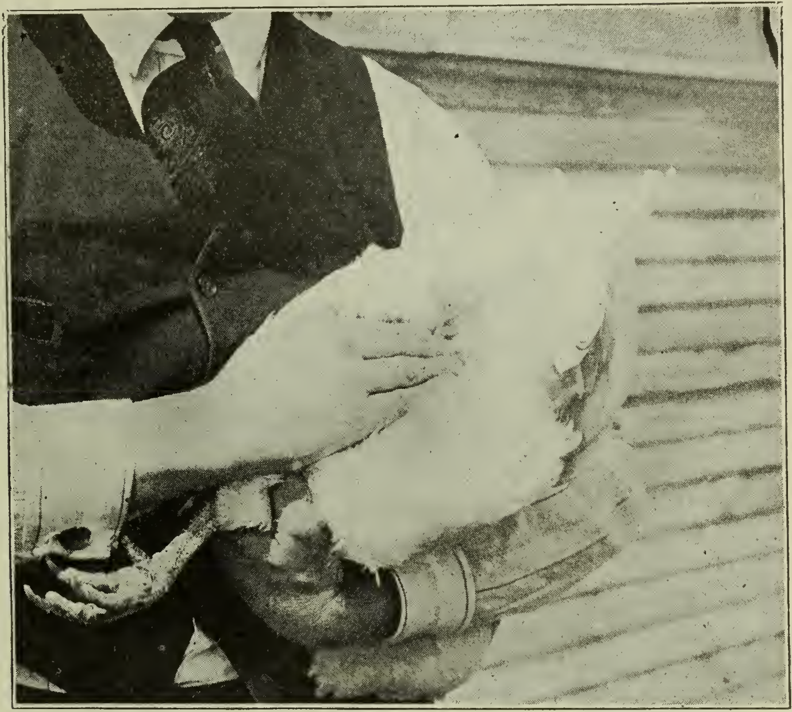
The egg-laying capacity of the hen is indicated by the capacity of her body. The heavy layer is also a heavy eater. To furnish room for the egg organs and for the digestion of feed she must having a well-developed abdomen. A measure of the body capacity is furnished by the depth from the end of the pin bones to the rear end of the keel. In culling, this distance is usually expressed in terms of fingers as determined by laying the hand across that part of the bird's body. The best producers will show a body depth of four or more fingers, while in the poorest hens the depth may not be more than one finger. The body depth is not dependent upon breed, but



Body capacity more than four fingers.

does vary with the laying condition. If the hen is not laying the abdomen is less distended and the bones come closer together thus decreasing body depth.

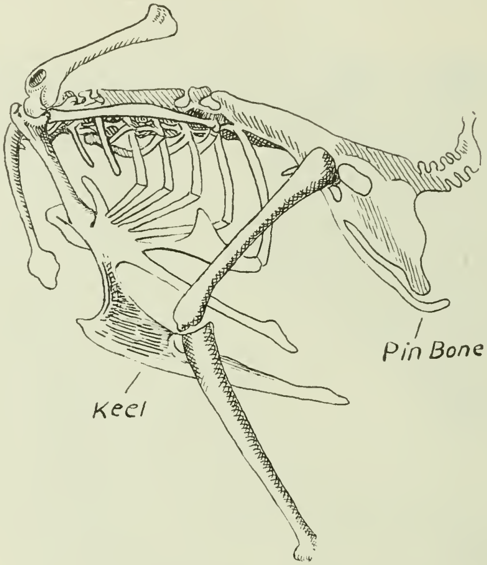
As a general rule any hen showing less than three fingers depth at culling time does not possess sufficient body room to make her profitable and should be sold. In measuring body capacity account must be taken of the occasional hen which has unusual depth and yet shows other indications of being a poor layer. This condition is often found where the birds are over-fat and have developed the trouble known as a broken-down abdomen.



Measuring width between pin bones.

LAYING CONDITION

One of the best tests of a hen's persistence and value as a producer is her ability to lay during the fall. As already pointed out the poorer hens stop laying early and molt. In culling it is important that the laying condition of the hen be noted. Hens are kept primarily for egg production and as long as the hen is laying she should not be sold.



Body skeleton of a fowl.

The distance apart of the pin bones furnishes one valuable test of laying condition. When the hen is laying these bones stand well apart and the ends of the bones are straight and flexible. When she stops laying the ends of the bones come closer together and become firm and unyielding. If the hen is laying heavily the ends of the pin bones are usually three or four fingers apart. As a general rule if the pin bones show a spread of less than two fingers the hen is not laying.

As already mentioned the depth of body is an indication of laying condition. Any hen showing a body depth of less than three fingers is seldom laying.

The flexibility of the abdomen is another indication of the laying condition. When the hen is laying the expanded abdomen is soft and flexible. When handled it suggests the texture of the partly milked out udder of a cow. When not laying the abdomen contracts and the flesh becomes thick and solid presenting a caked condition. When laying ceases the vent becomes dry and puckered and the skin between the pin bones is stretched tight.

By observing the width between the pin bones, the depth of body, the flexibility of the abdomen and the tightness of the skin around the vent, the non-laying hens can be picked out with great accuracy.

CHARACTERISTICS OF HIGH LAYERS

The best producing hens will show all of the following characteristics:

1. Vigor—Strong, healthy, active, gentle and happy.
2. Molt—Not molting before October first.
3. Pigmentation—Shanks and beak pale. Ear lobes showing no yellow.
4. Quality—Skin soft, fine and velvety. Breast bone ~~thick~~ Thin and of fine quality. Pin bones straight and flexible.
5. Laying condition—Adbomen soft and flexible. Vent moist and expanded. Body depth four fingers or more. Width of pin bones at least three fingers.

CHARACTERISTICS OF POOR LAYERS

The poor producers in the flock will show all of the following characteristics at culling time:

1. Vigor—Lazy, inactive, wild, cross.
2. Molt—Beginning to molt in July, August or September.
3. Pigmentation—Shanks and beak prominent yellow; yellow in ear lobes on Mediterranean breeds, such as Leghorns.
4. Quality—Skin thick, dry and coarse. Breast bone ~~thin~~ thick and blunt on the edge. Pin bones blunt and unyielding.
5. Laying condition—Abdomen hard. Vent dry and puckered. Body depth less than three fingers. Pin bones less than two fingers agart.

APPLYING THE CULLING SYSTEM

In culling the farm flock by the system outlined in this circular each of the five distinguishing characteristics should receive due attention. A remarkable correlation will be found in the different characteristics on either the extra good or the extra poor birds. No difficulty should be experienced in picking out the best laying or the poorest laying portion of the flock. With some birds, however, the distinguishing marks are not so distinct and may sometimes be rather contradictory. Thus one hen may be an early molter and yet show good body depth. Another bird may molt late and at the same time show poor quality. Birds of this type are usually medium producers and the owner must decide whether they should be kept or sold.

If the birds are being culled very closely with the idea of keeping only the highest producers then all those in the doubtful class should be disposed of. If only the unusually poor birds are to be sold then those showing uncertain characteristics should be kept. Any person who will examine a few hens keeping in mind the characteristics of the good producer as opposed to those of the poor producers should be able to cull satisfactorily.

SUMMARY OF POINTS FOR CULLING

I. *Aged hens*.—Sell all Plymouth Rocks, Wyandottes, Rhode Island Reds, Orpingtons, and other birds of the heavier types that have finished two laying seasons. Sell all Leghorns, Minorcas, Anconas, Campines and other birds of the lighter breeds at the end of the third season.

II. *Pullets*.—Sell all weak, deformed, late hatched or undeveloped pullets. Keep all mature, vigorous, healthy pullets.

III. *Yearling hens*.—**Sell these hens**; weak, sick, or over-fat; molting before the average of the flock; with prominent yellow shanks, beak or ear lobes; with coarse skin, keel and pin bones; small, hard abdomen; small spread between pelvic bones and rear end of keel; with coarse, stiff, pelvic bones close together.

Save these hens; healthy, strong, active; molting later than the average of the flock; with pale shanks and beak and no yellow in ear lobes; with soft pliable skin and fine quality bones; abdomen pliable; good depth between pelvic bones and rear end of keel; with pin bones thin, straight, flexible and wide apart.

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A. J. Meyer, Director

CIRCULAR 71 COLUMBIA, MISSOURI AUGUST, 1919

Sewage Disposal for Farm Homes

FRANK A. MECKEL

The two greatest conveniences of the home are (1) a system of running water, and (2) a sanitary method for disposing of sewage without making an unsightly and filthy muss at the back door. A sewage disposal system changes the farm from an unhealthy to a healthy and pleasant place to live—a place where the disease breeding fly will cease to flourish, because its food supply will have been taken away. It has been well said that man is his own worst enemy, and this point is brought home by a survey of the sanitary conditions on the average farm. Should the average farmer's city brother attempt to dispose of human wastes and other sewage as it is disposed of on the farm, he would have the health officer waiting on him in a hurry. The more crowded conditions in the cities have made such practices impossible, because they are a detriment to the health and comfort of others. Such practices on the farm are just as great a menace altho they are not felt so much because of the less crowded conditions; still the chances are there.

A method of sewage disposal which will appeal to the farmer of today must meet certain requirements in order to be popular. A few of these are: it should be easily installed, efficient in operation, not too costly, and one which requires little attention after once installed.

When these points are all considered, the sewage disposal system best adapted to the country home is the septic system which is followed by either trickling filters or sub-surface disposal. The installation and upkeep of such a system does not cost much and adds greatly to the comfort and well-being of the family. There is no good reason why the farm home should be without a simple disposal plant of its own.

The septic tank is a sewage disposal plant which is easily understood by anyone who will take the trouble to make an investigation of it. Many persons entertain the mistaken idea that a septic tank is simply some sort of a receptacle containing a chemical which renders the sewage harmless by its action upon it. Such is not the case, for, while there is a decomposition or rather a breaking down which takes place within the tank, it is one which is brought about by bacteria within the sewage itself, and no chemicals are added for this purpose. Septic action may be popularly described as the decomposition thru bacterial agencies of the sludge in the bottom of a sediment tank with the consequent production of gases and a breaking up and partial changing of the solid matter into liquid.

As the sewage passes thru a septic tank, a large amount of suspended material settles to the bottom of the tank, and is acted upon by bacteria and so changed that a portion of it is made soluble and is carried off in the effluent or outflow, while another portion is broken up into gases which escape from the tank.

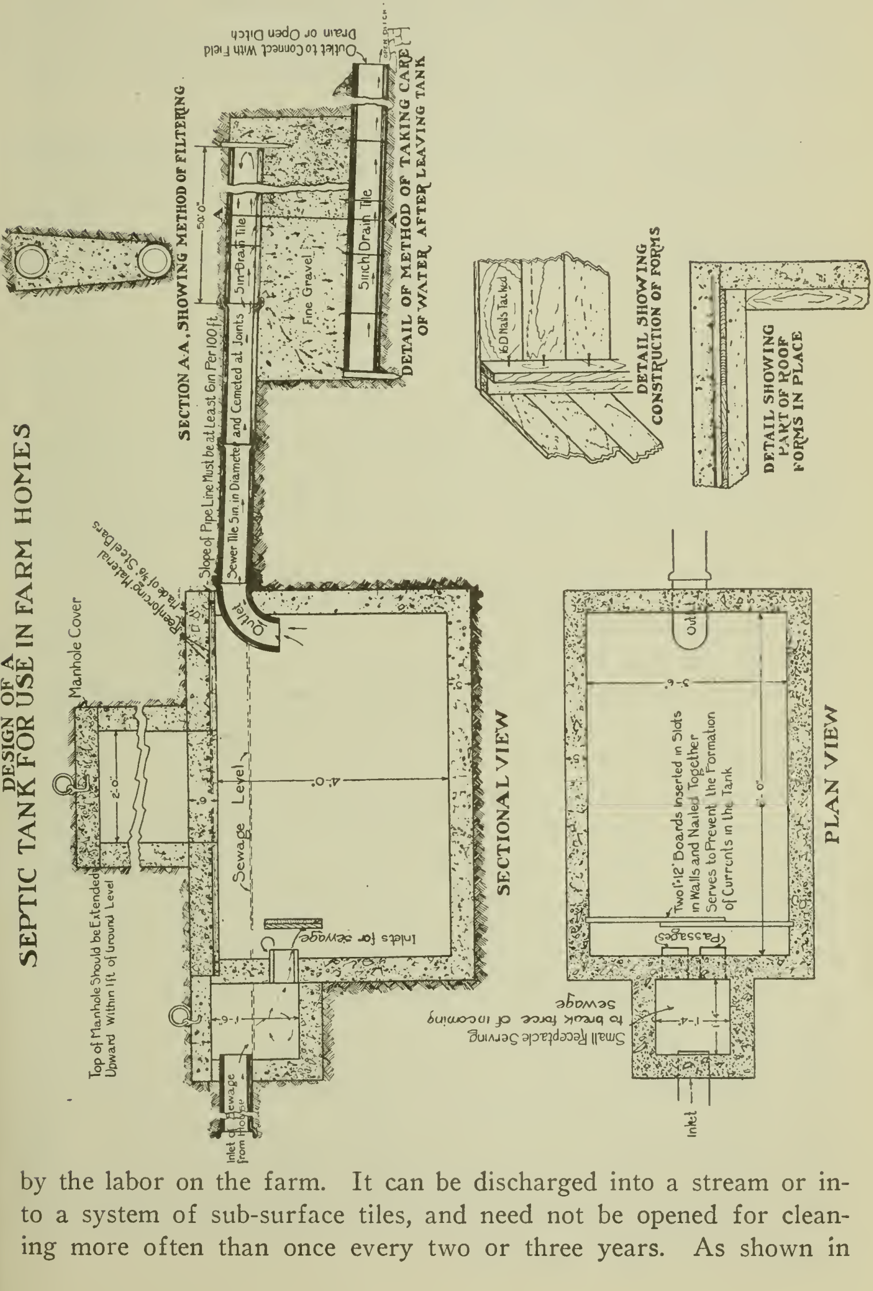
Experiments have been made showing that the bacteria in the tank are found on the sides, bottom, and top of the tank where organic matter accumulates and where the bacteria develop in great numbers compared with the numbers growing in the liquid passing thru the tank.

The suspended solids in a septic tank will mostly settle to the bottom of the tank where they are acted upon by the bacteria which in time render them soluble. As bacteria action proceeds, the settled particles become buoyant due to the gases generated during the process and rise to the top of the tank where they form a thick scum. In this way the solid matter of the sewage is liquefied.

After the sewage is discharged from the tank it must be oxidized by another group of bacteria found in the soil before it can be said to be harmless. For this reason the effluent is filtered thru sand and gravel, before it is allowed to run into a stream or ditch.

Where a considerable amount of sewage is to be disposed of daily, it is advisable to use a two chambered tank with an automatic dosing chamber and a siphon; but for the average sized family on the farm where only a small amount of sewage enters the tank during the day a single chamber tank does very satisfactory work, and the automatic siphon is not necessary, because of the slow rate of discharge.

This type of tank is very easy to build and may be constructed



DESIGN OF A SEPTIC TANK FOR USE IN FARM HOMES

SECTION A-A, SHOWING METHOD OF FILTERING
DETAIL OF METHOD OF TAKING CARE OF WATER AFTER LEAVING TANK
Outlet to Connect With Field Drain or Open Ditch
Open Ditch
50'-0"
5 in. Drain Tile
Fine Gravel
5 inch Drain Tile
Slope of Pipe Line Must be at Least 6 in. Per 100 ft.
Sewer Tile 5 in. in Diameter and Cemented at Joints
Reinforcing Material Made of 3/8 Steel Bars
Manhole Cover
Top of Manhole Should be Extended Upward Within 1 ft. of Ground Level
2'-0"
Outlet
Sewage Level
4'-0"
Inlets for sewage
1'-6"
Inlet of Sewage from House
SECTIONAL VIEW
DETAIL SHOWING CONSTRUCTION OF FORMS
16D Nails Tacked
DETAIL SHOWING PART OF ROOF FORMS IN PLACE
Outlet
3'-6"
Two 1"×12" Boards Inserted in Slots in Walls and Nailed Together Serves to Prevent the Formation of Currents in the Tank
Passages
Small Receptacle Serving to break force of incoming sewage
1'-4"
Inlet
PLAN VIEW

by the labor on the farm. It can be discharged into a stream or into a system of sub-surface tiles, and need not be opened for cleaning more often than once every two or three years. As shown in the accompanying drawing, the tank is constructed of concrete; a 1-2-4 mixture being recommended; i. e. one part cement, two parts sand and four parts crushed rock or gravel.

In building a concrete septic tank it is advisable to dig the excavation the exact size of the outer dimensions of the tank and in this way the ground may be utilized as the outer form for the tank. This will be a saving of lumber.

Septic tanks are sometimes built of brick or hollow tile, and such tanks, when properly constructed by a good workman give just as good service as the concrete. The difficulty with this type of construction, however, is that competent bricklayers are high priced mechanics, and are seldom to be found among the farm help. The septic tank should be made right the first time for it is a difficult and not a pleasant thing to repair later on. There is less chance of a man going wrong in laying concrete than there is in laying brick or tile, and concrete properly laid is permanent.

The filter shown in the drawing should be at least fifty feet in length and from eighteen to twenty-four inches in depth if possible. This will depend, of course, on local conditions such as the character of the ground itself, and the available fall. It should be filled with fine gravel and coarse sand. The sewage coming from the tank filters thru this material and is purified and taken out thru the lower drain tile which opens into a stream or field drain or ditch of some sort. At this point the sewage may be said to be harmless.

A septic tank will not freeze up and even in very cold northern winters the absorption tile in a sub-surface disposal area will work efficiently.

It is best to use the standard toilet paper in closets used in connection with a septic tank, as it dissolves much more readily than ordinary paper and has much less volume. Ultimately, practically everything, except such material as would become ash when burned, is dissolved in the septic tank. The ash settles to the bottom and slowly accumulates in the tank and must be cleaned out at intervals, as previously stated. After cleaning, the septic tank does not resume its former efficiency of operation until after a week or ten days time. Neither does a newly installed septic tank operate perfectly at first. From seven to ten days are required for the bacteria to begin working properly; so the man who has just installed a septic tank and finds that it is not working properly need not be at all alarmed, but he should remember that a little time is necessary for these bacteria to get into action and to muster up an army strong enough to commence operations.

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UNIVERSITY OF MISSOURI **COLLEGE OF AGRICULTURE**

AGRICULTURAL EXTENSION SERVICE

A. J. Meyer, Director

CIRCULAR 72 COLUMBIA, MISSOURI JANUARY, 1920

How to Breed Good Layers

T. S. Townsley

Farm poultry keepers are primarily interested in increasing the egg production of their flocks. To accomplish this it is necessary that attention be paid to the methods of feeding, housing, culling and breeding. Probably the least progress on most farms has been made in the art of breeding poultry. The purpose of this circular is to outline a simple system which may assist farm flock owners in breeding better layers.

A SPECIAL BREEDING FLOCK

To produce high layers only the best individual producers should be used as breeders. This suggests the necessity for having a special breeding flock. On farms where eggs for setting are saved from the entire flock, selection is usually based only on the size and shape of the eggs. With this system the breeder stands a good chance of setting many eggs from the very lowest producers. Even the poorest hens lay fairly well during the hatching season and their eggs are usually large and smooth. This method of mass selection of setting eggs is in the same class as the crib selection of seed corn and will bring just as poor results. The first step in improving the egg production is the establishment of a special breeding flock.

YARDING ARRANGEMENT FOR BREEDERS

No special fencing is necessary to handle the flock. Free range gives ideal conditions for breeding fowls. A *pen* is a great detriment to the efficiency of the breeding flock and is not at all needed on the farm. Close confinement reduces the vitality of the stock and results in poor hatches and weak chicks.

Where separate houses are available for the breeding flock and the commercial flock, free range can be given the birds in each group. If feed is kept constantly available in the mash hoppers in each house the birds will return to the proper house to lay so that the eggs can be kept separate without any attention to yards. Of course, males should be supplied only for the breeding flock, and by keeping these birds in the house until eight or nine o'clock in the morning, satisfactory mating will be insured. Some mating may occur on the range between the hens in the commercial flock and the males from the breeding flock, but this does no special harm. On farms where there is only one poultry house, a partition can be put in to keep the two flocks separate. If it seems undesirable to allow both flocks to range at the same time, alternate the range by letting the breeders run at large one day, and the commercial layers the next. During the cool weather of the breeding season this system works satisfactorily.

SIZE OF BREEDING FLOCK

The number of birds to include in the breeding flock should be determined by the number of high class individuals available and by the number of eggs needed for hatching. If incubators are used, enough breeders should be kept to fill the machines without holding any eggs longer than ten or twelve days. Usually a production of at least fifty per cent can be expected during the hatching season. Forty breeders should furnish enough eggs to fill a two-hundred egg machine within ten days. However, only hens of high producing ability should be used as breeders even if it is necessary to buy some eggs for hatching.

PUREBRED VERSUS MONGREL

Persons having mixed or mongrel flocks will do well to buy hatching eggs or baby chicks from purebred flocks instead of attempting to breed up the mongrel stock. There is no reasonable argument in favor of keeping any except pure bred fowls on the farm. Purebred birds lay better, develop more quickly, are more uniform in size and much more attractive than birds of mixed breeding. A gradual change to purebred stock can be made at small expense by buying enough eggs or baby chicks during the hatching season to furnish a breeding flock for the next year.

SELECTING THE BREEDING FEMALES

Only mature birds should be used in the breeding pens. Hens are more desirable than pullets because they produce stronger chicks and because the hens can be more accurately judged for laying ability than can pullets.

The best time to select the breeding pen is at culling time in the fall. Hens which molt late, show fine quality of skin and bone, have pale shanks and beak, and show a body depth of four or more fingers, are the best producers. Birds which show these characters in the fall should be marked and saved for breeders.

If the breeders are not picked out in the fall they can be successfully chosen during February. The birds which lay best during the winter are the ones which will make the best record for the year, and at mating time the best winter layers can be easily distinguished.

A good way to choose breeders is to go into the house when the birds are confined and catch all of the best looking fowls. These will be the ones with well-developed bodies, red combs, and an alert appearance. By examining each bird her vigor and laying ability can be determined, and any bird found lacking in either of these characters should be discarded.

Health and Vigor.—Strong vigor is indicated by a broad head; prominent, alert eyes; short, well-curved beak; red comb; broad chest; and a disposition to keep busy. Lack of vigor is shown by a narrow head; long, straight beak; listless or sunken eyes; pale comb; narrow chest; and a disposition to loaf. Any bird showing evidence of a cold or roup should not be kept.

Laying Ability.—The hens which have been heavy winter layers will show pale shanks and beak; no yellow in ear-lobes; soft, velvety skin; thin, smooth breast bone; straight, flexible pin bones; abdomen soft and pliable; vent, moist and expanded; width between pin bones at least three fingers; body depth from pin bones to end of keel four or more fingers. The poor layers will have thick, coarse skin; prominent yellow shanks and beak; yellow in ear-lobes, if Leghorns; breast bone thick and coarse; pin bones thick and unyielding; abdomen hard; vent dry and puckered; body depth less than three fingers; and the ends of the pin bones less than two fingers apart.

If some pullets must be used for breeders, only those which have laid heavily during the winter should be selected. The heavy layers among the pullets will have a red comb, pale skin, good width between pin bones, soft abdomen, and at least four fingers body depth.

CHOOSING THE BREEDING MALE

The most certain method of improving the egg production thru breeding is to use only males which are the sons of known high producers. Males from hens which have laid more than two hundred eggs in one year are of special value in transmitting the high-producing character to the pullets. Since the male furnishes half of the blood for the flock, much care should be used in choosing him. Farm poultry keepers can afford to pay a good price for a vigorous male from a heavy-laying strain. Unfortunately, not nearly enough males from trap-nested stock are available to supply the demand for such birds.

Where a pedigreed male can not be obtained the next best plan is to choose from a good producing flock an outstanding, scrappy male with strong vitality. No proved method of picking out by physical tests the male which will transmit high egg production has yet been perfected, but vitality and egg production are closely linked and no male showing a weak constitution should be tolerated as a breeder. The strongest males can be easily detected by the marked evidences of masculinity such as gallantry toward the hens, fearlessness in fighting, and a persistent tendency to crow lustily. The boss of the hen yard is usually the best breeding male.

A well-matured cockerel usually gives better breeding service than an older male, tho good results can be obtained with strong yearling cocks. Many breeders use the same males to head the breeding flock for two successive years.

RATIO OF MALES TO FEMALES

Where a valuable male is secured for the breeding flock it is desirable that he be mated to the maximum number of females. The number of hens that can safely be allotted to each male depends to a certain extent upon the breed and the vigor of the male. A strong, fully matured cockerel of the medium weight breeds such as the Plymouth Rocks, Wyandottes, and Rhode Island Reds can safely be mated with from twenty to twenty-five hens, while with the lighter breeds such as Leghorns one male will furnish good fertility when mated with from twenty-five to forty hens.

SUMMARY

1. Establish a special breeding flock.
2. Breed only from purebred stock.
3. Give breeders free range.
4. Breed only from high producing hens.
5. Use a male from a heavy-laying mother.
6. Allow from twenty to forty hens to each male.

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AGRICULTURAL EXTENSION SERVICE

A. J. MEYER, DIRECTOR

CIRCULAR 73 COLUMBIA, MISSOURI FEBRUARY, 1920

Feeding the Baby

From the Weaning Period Thru the Second Year

Anna C. Jensen

WEANING THE WELL BABY

The baby that is not normally well should be fed and weaned according to directions furnished by a competent physician who can watch the child's progress constantly. Most authorities agree that the normally well baby will thrive better if it is weaned soon after the ninth month. Weaning should not be started, however, during or just before the hot months. Rather than to wean then, weaning may be started as early as the seventh month, particularly if the mother is not strong or her milk not abundant, or may be postponed a couple of months until the weather is cool. Mothers should not nurse their babies longer than twelve months. After that, the mother's milk changes in composition so that it is not sufficiently nourishing and may even be harmful to the baby. To continue nursing, therefore, does the baby no good and saps the strength of the mother.

HOW TO WEAN

Sudden weaning should not be attempted unless necessary. The baby's digestive tract is very tender and must be gradually accustomed to new foods. Only a little of the strange food must be given at a time until the mother is sure that the new food is agreeing with the baby. The mother will not continue to have a supply of breast milk unless she continues to nurse her baby. To keep up her supply of milk until the baby is able to digest cow's milk, she may give the baby one feeding a day of modified cow's milk, at 10 a. m. or 2 p. m., and breast milk at the other feedings. When she is certain that the baby is able to digest cow's milk the breast milk feedings should be stopped entirely. The flow of milk will gradually disappear, but can be retained long enough for her to assure herself that the baby will not suffer by having his milk changed. A normal baby that has reached twelve months without being weaned, but has been given cow's milk occasionally, in addition to the breast milk, may be weaned quite rapidly; but babies that are weaned young, are somewhat underweight, or are not strong, need to be weaned very gradually and carefully.

The use of a cup and spoon instead of a bottle for the milk in weaning is recommended unless the baby is weaned when he is as young as seven months. This will save the busy mother the care of the bottles and nipples. Since it is better to hold a baby while he is taking milk from a bottle, feeding with a cup and spoon will not take more of the mother's time than she would use in giving the bottle feeding correctly.

FOODS TO GIVE IN WEANING

Cow's Milk.—Cow's milk is the best substitute for mother's milk and should be the staple food in the diet of children if they are to develop strong bodies and good teeth and bones. It should be clean, fresh (not more than thirty-six hours old), from cows free from tuberculosis, preferably a mixture of the milk of several cows, and should be sterilized. The milk should not have too high a fat content. About four per cent fat is desirable. If rich Jersey milk is used some of the fat should be removed. Care must be taken in the home always to keep the milk clean, cool and covered. If fresh cow's milk cannot be procured powdered milk is the best substitute.

Young babies need each day one and one-half ounces of milk for each pound of their body weight, but they should never be given more than a quart of milk daily.

The young baby who weighs over 21½ pounds does not need more than a quart of milk, because his extra weight is fat and he needs milk primarily for building such body tissues as muscles and bones. After a baby is nine months old 1¼ to 1⅓ ounces of milk to each pound of his weight is usually enough, but 1½ ounces of milk a day for each pound of his weight may be continued if the child seems to need it, up to the point where he is getting a quart of milk a day.

Additions to the milk.—If the baby is weaned when he is younger than nine months old, maltose or lactose (kinds of sugar that can be bought at the drug store and that are less sweet than cane sugar) should be added to the day's milk supply to the amount of one-eighth of an ounce for each pound of the baby's weight. The milk also should be diluted with boiled water so that at each feeding the baby is given one ounce more than the capacity of his stomach. Average capacity of a baby's stomach at different ages is as follows:

AGE	CAPACITY
7 months	6½ ounces
8 months	7 ounces
9 months	7½ ounces
10 months	8 ounces
11 months	8½ ounces
12 months	9 ounces

A baby seven months old who weighs 19 pounds, if he has five feedings a day, one of which is to be cow's milk, should have that feeding figured as follows:

Milk—19 x 1½ ounces = 28½ ounces a day ÷ 5 = 5.7 ounces, or about ¾ cup for one feeding.

Maltose—19 x ⅛ ounce = 2⅜ ounces a day ÷ 5 = ½ ounce, or about 1 level tablespoonful to the feeding.

Boiled water—6½ ounces (capacity of stomach at 7 months) + 1 ounce = 7½ ounces food to be given — 5.7 ounces of milk = 1.8 ounces, or about 3 tablespoonfuls water in each feeding.

A bottle or cup marked in ounces will be a great convenience. If this can not be obtained and a measuring cup can, remember that 16 ounces equal 1 pound, which is 1 pint of milk or 2 cupfuls of sugar. One ounce of sugar equals 2 level tablespoonfuls.

If maltose or lactose cannot be obtained or the price cannot be afforded, cane sugar can be used. It is undesirable, however, to give a baby that is being weaned as much as one-eighth ounce of cane sugar for each pound of his body weight, because he will develop an appetite for sweet food that will make it difficult to change his food later to milk and unsweetened cereal jelly. Half as much cane sugar as maltose, therefore, may be added to each feeding and the additional energy that the baby needs can be supplied by adding some thin gruel.

Adding cereal to the milk.—Barley flour is best to use every day for the gruel, but other cereals can be used. Oatmeal is good if the baby is constipated, and rice if his bowels are loose. Whole cereals need to be cooked four to six hours in a double boiler on the back of the stove or over night in a fireless cooker, but barley flour needs to be cooked only a couple of hours. One and one-half level tablespoonfuls of raw cereal or flour for the day's five feedings is a good amount to start with. If only one substitute feeding is being given, this will mean that about one teaspoonful of the raw cereal is needed. A level tablespoonful cooked in enough water so that it will measure a little over one-half cupful when thoroly cooked will be enough for three feedings. The cereal must be strained through a fine strainer before it is added to the milk. The amount of sugar should be gradually decreased and the amount of cereal gradually increased until the baby is getting at the end of the ninth month no sugar and about ½ to 1 ounce of cereal in his day's feedings. One-half to 1 ounce of uncooked cereal will measure from 1 to 4 level tablespoonfuls, depending upon the kind of cereal used. One ounce of flour, or flaked cereals such as rolled oats, measures uncooked about 4 tablespoonfuls; 1 ounce of rice or granulated cereals such as cream of wheat, about 2 tablespoonfuls; 1 ounce oatmeal or cornmeal, 3 tablespoonfuls. Make all measurements absolutely level.

Preparing the milk feeding.—When one substitute feeding is being given, the milk, sugar and water, or milk, sugar, cereal gruel, and water, should be mixed and brought quickly to the boiling point, cooled quickly until of body heat, and given to the baby. If two or more feedings are given, they should all be prepared at one time. After the milk has been brought to the boiling point, it should be divided into as many sterilized bottles as there will be feedings, the bottles plugged with cotton and the milk cooled. To sterilize the bottles put them in cold water, bring the water to the boiling point and boil ten minutes. Before giving the milk to the baby place the bottle in a pan of water and warm until it is of body heat.

Foods to give in weaning the nine-months-old baby.—If the baby is not weaned until after he is nine months old, the cow's milk should not have sugar added to it but should be given with a little cereal jelly. After nine months the baby requires only four feedings a day. For one substitute feeding multiply his weight by 1½ (ounces) and divide by four which gives the ounces of milk to give for one feeding. To the milk, add cereal jelly made by cooking cereals four to six hours on the back of the stove or in the fireless cooker and straining thru a fine strainer. Oatmeal, cracked wheat and cream of barley are good cereals to use. A child of this age needs in his four feedings one-half to one ounce of cereal a day, which when measured uncooked is one to four level tablespoonfuls, depending upon the kind and amount used. Use one-fourth of this amount when only one substitute feeding is given. When starting with a new cereal, however, the mother should give only one-half the required amount or less and increase gradually. When the baby is entirely on cow's milk it will be found easier to give the cereal jelly with only two feedings, preferably the second and fourth ones and at first to dilute the other two feedings with boiled water. Add enough water to bring the amount of milk up to an ounce more than the capacity of the baby's stomach at that age. As the amount of milk increases, gradually decrease the amount of water used so that at the end of the first year the baby is drinking undiluted warm cow's milk. As before, the milk should be brought to the boiling point and cooled quickly until lukewarm before serving.

There is nothing more important to remember in feeding babies than that babies show such individual differences in the way they take care of food that no hard and fast rule as to amount or kind of food can be made. New foods must be introduced slowly and carefully and amounts increased gradually. It is better to underfeed the baby for a short time than to run the risk of his having an attack of indigestion.

Other foods a baby needs.—*Fruit juices* are needed to correct tendency to constipation, and to add iron. Strained orange juice, prune or tomato juice are best to start with, and later, apple, pineapple and peach juices may be used. When feeding a new fruit juice begin by giving each day only one teaspoonful diluted with water and increasing until one to three tablespoonfuls a day are given undiluted. A good time to give the fruit juice is between the two morning feedings.

Bread.—Dry toast or zwieback may be given to children when they have teeth, after the milk feeding. They should be taught to chew in order to stimulate the flow of saliva in the mouth and to develop the teeth. Soft breads should not be given at any time. Bread may be dried out over a slow fire and browned or an oven may be used. Enough bread may be prepared for a day or two at one time and stored in a heavy paper sack.

Water.—All babies should be given cooled boiled water between feedings.

FOOD AFTER WEANING OR THRU THE SECOND YEAR

The same principles of regularity and gradual training of the digestive tract to care for new food should be followed. It takes three hours for cow's milk to leave the stomach, so plenty to eat at meal times and no piecing between meals is necessary if the stomach is to have needed rest periods. Four feedings four hours apart are desirable.

Milk is the one food a growing child can not do without. One quart is needed until the baby is eighteen months old, then three cups or one and one-half pints to a quart until he is twelve years old, and at least one pint from then on.

Cereal.—Whole ground grains such as wheat, barley and oats are the best cereals to use since they contain more needed mineral salts. They should be cooked 4 to 6 hours, *strained* and given as a jelly with two meals each day. After two or three months of strained cereals the finer varieties can be given unstrained, and later any thoroly cooked unstrained cereals. Do not add sugar to cereals.

Fruit.—Two or three tablespoonfuls of fruit juice or strained, cooked pulp should be given every day, the pulp being introduced gradually. The best time to give it is between the morning meals. It is safer not to give a baby of this age raw fruit pulp. If given, the fruit must be very ripe with no sign of spoilage and the pulp should be soft and scraped or mashed so that it will be finely divided.

Dry bread or toast should be continued.

Egg yolk.—By the time the baby is weaned he should have a little soft cooked yolk of egg occasionally to give him additional iron. Gradually increase the amount until he is getting as much as a yolk at one feeding on several days a week. Remember that spinach, orange, or tomato juices are also valuable sources of iron, so that if these are given less egg yolk is needed, but if not enough of these are obtainable, and eggs agree with the baby, a yolk a day may be given. Do not use the white of the egg if the baby gets one quart of milk.

Vegetables.—As the baby becomes accustomed to other foods, he may occasionally be given strained, mild-flavored, green vegetables. Spinach is the best; green peas, asparagus tips, young carrots, are good. At first give only one to three teaspoonfuls of the new kind of food and add it to the milk. After the eighteenth month, a strained vegetable should be given every day, served plain with a little cream or in slightly thickened milk as soup.

Other foods are not needed by a child of this age. To give them is likely to weaken the baby's delicate digestive tract and cause him to develop a taste for highly flavored foods that will spoil his taste for the milk which is absolutely essential. Babies should not be expected to eat an adult's food any more than they are expected to do a grown-up person's work. Parents should be ashamed to say "my baby eats everything." Because he can swallow food is no reason for believing that his body can take care of it without injury. Unfortunately, the penalty for wrong feeding does not always come until later life and may only show at the time in a cross, fretful baby or in a greater tendency for the baby to take colds or other diseases. The good health of grown persons depends largely upon what they were fed when they were children, so too much thought and care cannot be given the subject.

You may be sure your child is well fed if he is:

1. A healthy normal child who sleeps quietly thirteen to fifteen hours a day, has firm flesh, bright eyes, good color and a happy disposition.

2. Of average weight for his height and age, and makes a gradual gain in weight.

DIETARY FOR CHILD—18 MONTHS TO 2 YEARS OLD

(From "Feeding the Family" by Mary Swartz Rose)

TIME	FOOD	AMOUNT
6 a. m.	Warm milk	1 cup
8 a. m.	Orange juice, prune pulp, or baked apples	2 to 3 tablespoonfuls
10 a. m.	Strained cereal jelly	2 to 3 tablespoonfuls
	Top milk for cereal	1 to 2 tablespoonfuls
	Warm milk to drink	¾ to 1 cup
	Stale bread, dry toast, or plain zwieback	1 to 2 slices
2 p. m.	Yolk of an egg	
	Stale bread or dry toast	1 to 2 slices
	Strained spinach or strained green peas	2 to 3 tablespoonfuls
	Warm milk to drink	1 cup
5:30 p. m.	Cereal jelly	2 to 3 tablespoonfuls
	Top milk	2 to 4 tablespoonfuls
	Stale bread	1 to 2 slices
	Warm milk to drink	1 cup
10 p m.	Warm milk to drink (only if baby is awake)	1 cup

GOOD HEALTH SUGGESTIONS

To have a healthy baby see that in addition to proper food he has the following:

Undisturbed sleep for from thirteen to fifteen hours, depending on the age of the baby, in a ventilated room which has windows opened so no draft blows on the baby.

Clean, loose, comfortable, washable clothing which will keep the baby cool in summer and warm in winter.

Daily bath.

Daily airing. In very cold or damp weather, bundle up the baby and protect him from drafts, open the windows wide and give indoor airing.

Regular bowel movements once or twice a day.

A chance to grow and develop his own muscles without having his nerves upset by being jolted, bounced, tickled, or romped with. The baby who leads a monotonous life and is not amused or expected to be amusing will develop the strongest nervous system.

Freedom from irritation of strong lights, harsh noises, confusion of crowds, etc. The movie is no place for young children.

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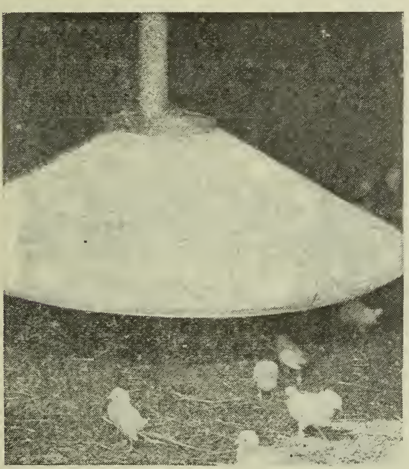
EXTENSION SERVICE
A. J. Meyer, Director

CIRCULAR 74 COLUMBIA, MISSOURI FEBRUARY, 1920

The Missouri Colony Brooder House

T. S. Townsley

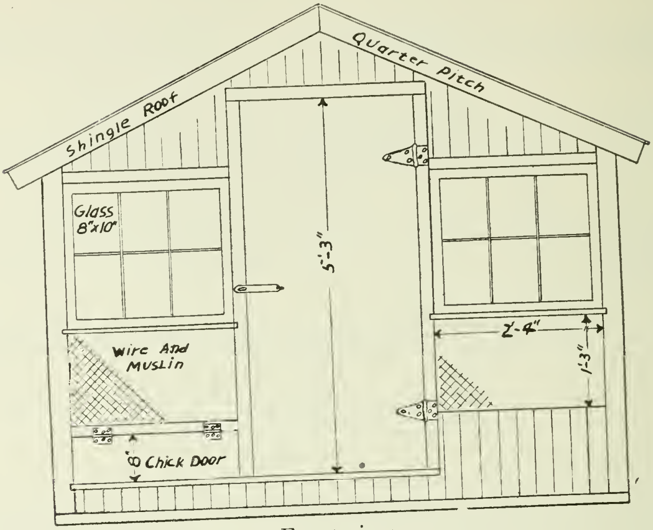
Stove brooders afford the easiest and cheapest method of brooding large flocks of chicks. Farm poultry keepers who appreciate efficient equipment are rapidly discarding all other brooding methods in favor of the colony stoves. With the coal or oil-heated colony hovers from three hundred to five hundred chicks can be handled in one flock with no more labor than is required with a few dozen chicks brooded with hens or in lamp-heated brooders. The chick mortality is remarkably low on farms using colony stoves and little difficulty is experienced in raising early hatched chicks. The fuel cost for brooders is low, and the stoves are durable.



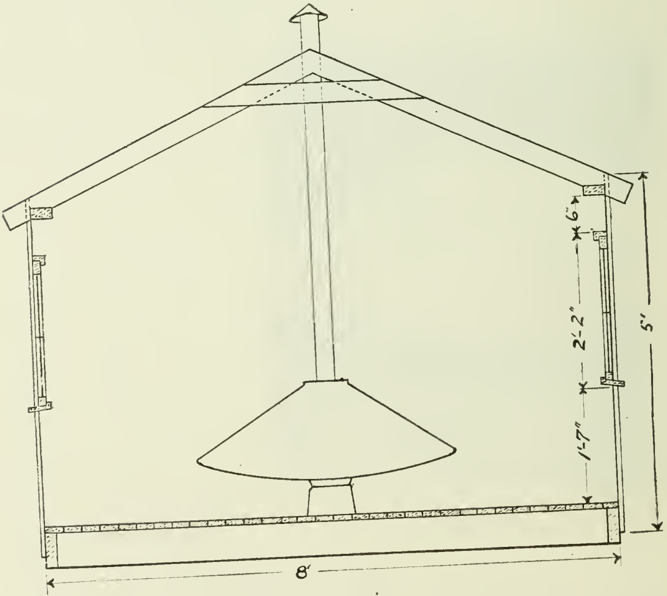
A modern stove brooder

Brooder stoves are used in all kinds of buildings but best results are secured with a specially designed colony house. The brooder house should be warm, dry, well lighted and ventilated, and be large enough to furnish room for exercise. It should also be movable so that the chicks may have fresh ground for their range.

The Missouri Colony Brooder House is designed to meet at least expense all the requirements of a farm brooder house. This house is built eight feet wide and ten feet long with a gable roof. The gable roof construction has several advantages over other types. It requires



Front view

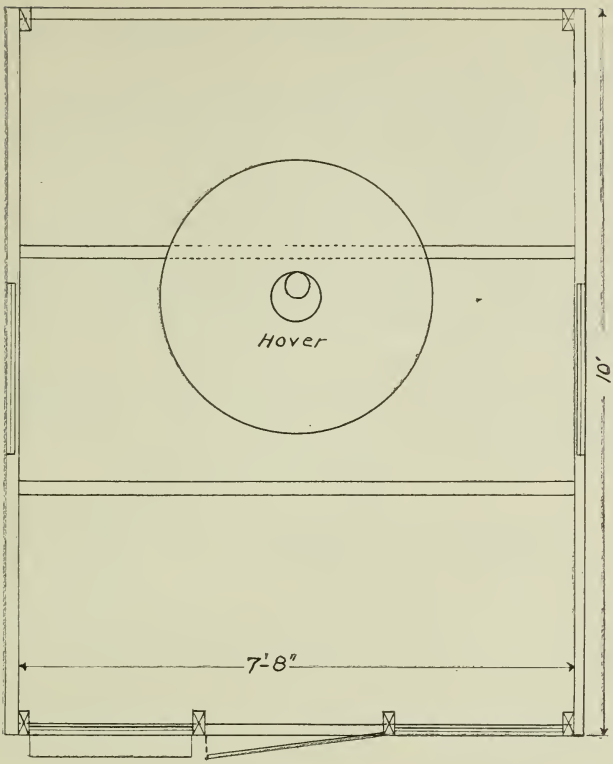


Cross section

less lumber, is more substantial, easier to move, and affords bette interior arrangement than other houses.

BUILDING DETAILS

Walls.—The walls are of car siding, nailed up and down. Thi forms a tight wall and eliminates the use of studding except at th corners. Flooring may be used for walls instead of the car sidin



Floor plan

These tongue-and-groove materials make a tighter wall than other forms of siding and are no more expensive.

Floor.—In a movable house a board floor is the only practical type. This should consist of a single layer of carefully laid matched flooring. A double floor is a needless expense.

Roof.—A shingle roof makes less weight on the building than most other types and is less likely to be damaged in moving the house.

Foundation.—A block under each corner of the house provides a satisfactory foundation. When the house is to be moved it can be set on a pair of skids.

Ventilation.—Ventilation is secured thru two openings in the south end of the house. These may be covered with muslin in stormy weather. Additional ventilation may be secured in warm weather by opening the windows.

Light.—Four small windows supply light for this house. Two of these are placed in the south front and one in the east and one in the west sides. This arrangement insures good light in all parts of the house.

COST OF HOUSE

The material in this house at current prices in Columbia will cost about fifty dollars. The cost of labor in building it should not exceed ten dollars. In many sections of the state these figures can be considerably reduced.

The cost of a house of this type is not prohibitive for most poultry keepers when the many uses which can be made of it are considered. After the brooding season is passed the house makes ideal summer quarters for growing pullets. During the fall and winter months it will comfortably house twenty to twenty-five laying hens, or it will make a convenient house for storing feed. Before brooding time in the spring it can be used as a house for the breeding flock. The fact that it is easily moved adds greatly to its usefulness.

BILL OF MATERIAL

USE	PIECES	SIZE	BOARD FEET
Sills	4	2x6—8	32
Sills	2	2x6–10	20
Rafters	8	2x4—5	27
Plates	2	2x4–10	13
Studs	4	2x4—5	13
Door Posts	2	2x4—6	8
Nailer, rear wall	1	2x4—8	5
Short pieces, front	5	2x4—2½	9
Sheeting	18	1x4–11	66
Finishing, cornice	4	1x4—5	7
Finishing, corner strips	4	1x4—5	7
Finishing, short pieces	4	1x2—2½	2
Window sills	4	1x3—2½	3
Finishing, door	2	1x2—5½	2
Door sill	1	1x3—5¼	1
Flooring	32	1x4—10	107
Siding		1x4—10	225

Total lumber	547
Shingles	1¼ M
Windows	4, 6 light, 8x10 sash
Wire netting for windows and open front	15 linear feet of 2 ft. wire
Muslin for open front	1 yd.
Hinges for doors	1 light and 1 heavy pair
Hasp for door	1, 6 in. hasp

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COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS

University of Missouri College of Agriculture and the United States
Department of Agriculture Cooperating
A. J. Meyer, Director Agricultural Extension Service

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CIRCULAR 75 COLUMBIA, MISSOURI MARCH, 1920

(A Revision of Circular 20)

The Way to Grow Soybeans

W. C. Etheridge

The soybean has become an important crop in Missouri. It is one of the best forage plants among the legumes and it exceeds any of the legumes in yield of seed.

Soil Requirements.—The soybean does not require a particular kind of soil. It will make a satisfactory growth even on poor soil, provided such soil is inoculated. Probably its best growth is made on loams and clays. It will withstand a great deal of moisture in the soil, but will not thrive where water stands on the land for a considerable time. On the other hand, the soybean is decidedly drouth-resistant.

Soil Preparation.—For its best growth, the soybean requires better preparation of the land than is necessary for cowpeas, because it cannot compete with weeds and grass so well as cowpeas. Clean land, prepared as for corn, is necessary for a good crop of soybeans.

Fertilizer.—The application of fertilizer to the soybean crop on either fertile or highly fertile land is usually not profitable. But on poor land good returns will nearly always follow a light application, 100 to 150 pounds per acre, of acid phosphate; or a light dressing, 5 or 6 loads per acre, of stable manure. There is seldom any profit in applying commercial nitrogenous fertilizers to soybeans, for this crop gets nitrogen from the air, thru the aid of nitrogen-gathering bacteria on its roots.

Altho the soybean will grow on sour, poorly drained land much better than red clover and alfalfa, it is greatly benefited on such land by lime. In fact, under nearly all conditions a moderate application of lime will usually give good returns.

Inoculation.—Altho on fertile soils inoculation is not necessary for a thrifty growth, it will usually benefit the crop, and on poor land it is essential for even a moderate growth. In sections where the soybean has long been grown, its nitrogen-gathering bacteria are naturally present and artificial inoculation is not required or even beneficial. But for sections into which the crop has recently been introduced, artificial inoculation will nearly always give good returns. Inoculating material, and instructions for its use, may be secured at cost from the Missouri College of Agriculture, Columbia, Mo.

The Way to Plant.—The soybean crop may be planted in rows, may be drilled, or may be sowed broadcast. It should be planted according to the purpose for which it is to be used.

A crop intended for seed should always be planted in rows which are far enough apart for convenient cultivation. Three feet is the usual distance, altho they are sometimes as far apart as 44 inches. On poor land a crop intended for hay will usually yield more when planted in rows and cultivated than when drilled or sowed broadcast. And also when the land is foul with weeds and grass, planting in rows will be necessary, for under such conditions the crop must be cultivated to be successful.

But when a crop intended for hay is to be planted on good land, it should be drilled or sowed broadcast. For even tho twice the quantity of seed is required, drilling or broadcasting is advisable for the production of hay on good land. The yields will be larger and the hay of finer quality.

An ordinary grain drill is the best means of planting a crop of soybeans when a thick growth for hay is desired. It may also be used when the crop is to be planted in rows for seed. By covering some of the feedcups in the drill, the rows may be spaced as desired. The corn planter, however, is somewhat more satisfactory than the grain drill for planting the crop in rows, provided care is taken to plant very shallow. Special plates for planting beans are now furnished with most modern corn planters. When a special bean plate is not at hand, the corn plate which makes the heaviest seeding may be used.

Don't Plant Too Early.—The soybean may be planted at any time after the last killing frost in spring and until midsummer. But there is no advantage in planting very early before warm weather. A considerable part of the early planted crop is usually killed by cool weather and the rest of it makes practically no growth until warm weather comes. Also, the early planted crop is likely to be bothered by the early weeds which are not hindered by cool weather.

The best date for planting soybeans will of course vary with the locality, but it is a safe practice to put in the crop about 2 weeks later than the average time of planting corn.

Don't Plant Too Deep.—The depth of planting is an important point. The seed must be planted shallow or poor stands will result, for the soybean seedling has not the power to push itself thru a deep covering of soil. Experiments have proved that 2 inches is the most favorable depth. Planting much deeper than this will greatly reduce the stand.

If a hard crust forms on the surface before the seed has come thru, it should be broken with a smoothing harrow or a weeder, otherwise the crust will tend to reduce the stand.

Quantity of Seed to Plant.—A crop planted in rows three feet apart will require fifteen to twenty pounds of seed to the acre, while a broadcasted or drilled crop will require sixty to ninety pounds to the acre. Soybean seed weigh sixty pounds to the bushel, but they vary greatly in size. Thus, 2100 seed of the Mammoth variety and 6400 of the Peking variety are contained in a pound. For economy in the use of seed an adjustment of the rate of planting according to the size of seed is therefore necessary; the larger quantities, just mentioned, should be used of large seed, and the smaller quantities of small seed.

Cultivation.—When the soybean crop is planted in rows which are far enough apart to make cultivation convenient, it should be cultivated two to four times, depending on the season and the condition of the land. If the rows are much less than three feet apart, the ordinary two-horse cultivator can hardly be used and the crop would have to be worked with a one-horse implement. For economy in cultivation it will be best to make the rows at least three feet apart, especially if a large acreage is to be planted.

The cultivation should be shallow and level—a level surface makes for convenience in harvesting. Altho in low wet land ridges provide some drainage, a crop grown on ridges is very difficult to cut with any of the ordinary kinds of cutting machinery.

When the crop is drilled or sowed broadcast, it should be cultivated once or twice with a weeder, first just before the beans have come up, and again when they are about three or four inches high. If this work is done in the middle of the day when the plants are tough, few of them will be broken; but if it is done in the morning or evening or soon after a rain, when the plants are tender, many of them will be destroyed. And many of them will be destroyed if the weeder is used just as the plants are coming thru the ground.

By care and good judgment in using the weeder a larger and cleaner yield of soybean forage may be secured.

Harvesting.—The common practice in harvesting soybeans for seed is to cut the crop with a binder or mower, cure it, and thresh out the seed. The crop should be cut when the seed have matured, but before the pods have dried. If an overripe crop is allowed to stand in the field the pods burst and much of the seed is lost. Probably no other legume shatters as badly as overripe soybeans. The yield of soybean seed may where the crop has been carefully harvested, range from 10 to 25 bushels per acre. On good land a well-managed crop may reasonably be expected to yield 20 bushels per acre.

Soybeans may be cut for hay at any time after the seeds are well formed and before they have hardened. Ordinary yields of cured hay range between 1 and 3 tons per acre, altho yields of 4 to 5 tons on good land have been reported. The average yield is about 2 tons per acre.

Good Varieties.—The Missouri Experiment Station is making tests over the state to find the best varieties of soybeans. At present Medium Yellow (also known as Mongol), Mikado and Morse are recommended for seed and for general purpose crops. Wilson is a variety especially recommended for hay. It is leafy, fine-stemmed, and a fairly good seed producer. Ito San is an extremely early variety maturing in 80 or 90 days, and is useful for late planting, altho not a heavy yielder of either seed or forage.

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COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE AND THE UNITED STATES
DEPARTMENT OF AGRICULTURE COOPERATING
A. J. MEYER, Director Agricultural Extension Service

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CIRCULAR 76 COLUMBIA, MISSOURI MARCH, 1920

Cooperative Wool Marketing

D. A. Spencer

For several years cooperative wool marketing has been conducted in a few widely separated Missouri communities. Farmers are asking for help to sell their wool in such a way as to get the high price for it. The state-wide wool pooling accomplished during 1919 in Iowa, Illinois, and Ohio has created intense interest, and Missouri sheep raisers are inquiring into the possibilities of improved methods of wool pooling in this state.

WHY MARKET WOOL COOPERATIVELY?

A very important reason for marketing wool cooperatively is that this method may enable the farmer to sell his wool as nearly as possible direct to the manufacturer. Wool dealers and commission firms are useful insofar as they are able accurately and efficiently to grade, store, buy and sell wool. They are necessary, but unless they are able to make the sale fairly direct to the manufacturer, there is danger of too much of the farmers' just returns being consumed by middlemen. Experts who can value wool accurately are exceedingly scarce, and in order to sell wool on its merits, the average farmer finds it absolutely necessary to sell in cooperation with sheep men in his community, county or state. Of course, an occasional farmer may have successfully consigned his individual clip to a reliable dealer or commission firm, but if the majority of sheep raisers in Missouri should attempt to market individual clips without any cooperation, it would be impossible for those dealers and commission firms that are able to value wool accurately, to render satisfactory service. These highly specialized firms are so scarce that without cooperation, or without local dealers to gather country wool for them, it would be utterly impossible for them to make prompt returns and handle the tremendous flood of correspondence which would be necessary.

WHAT HAS COOPERATIVE WOOL MARKETING ACCOMPLISHED?

Several local wool pool associations of Missouri have been very successful in securing satisfactory prices for their wool. Some of them have reported sales averaging from eight to ten cents a pound higher than the bids they were offered locally on the same wool. Such a saving is, of course, encouraging, but these wool pools have accomplished even more. They have made it possible for the best wool to sell for the top price, because in the successful sales all wool has sold on its merits. For example, in July, 1919, choice medium wool was worth about sixty cents a pound, while hard, burry wool was worth no more than thirty-five cents. The advantage in selling these wools of various values on their merits, or for just what they are worth, is an encouragement to the producer of good wool.

Country merchants are often handicapped in buying wool because in many cases they are not well informed in regard to exact wool values. It is true that an occasional country dealer specializes in wool and is thoroly informed in regard to grades and values, but such country dealers are exceedingly scarce. If these well-informed country dealers are honest and willing to give the growers a square deal, they may be valuable men in their respective communities, and should undoubtedly be given recognition. Even then, cooperative pooling cuts out waste by making it possible for dealers to offer their bids without running all over the country to examine the clips on each individual farm. It is the farmers' business to reduce this waste of the wool buyer's time, for if they do not they will eventually have to pay for it by accepting lower prices for wool.

Actual experience at local wool sales has shown that wool experts from warehouses in the big wool centers are more quick and keen in bidding to the top than are many country dealers. This does not necessarily minimize the ability of all country dealers; nevertheless the fact remains that in the experience of representative Missouri wool pools, the wool experts have been able to make the fine distinction, which of course favors the grower of good wool.

The old system of selling wool at the farm, in the majority of cases, has resulted in more or less flat-rate sales. The rate has varied some, but the variation was more according to what the grower and dealer would agree on than it was because of the actual market value of the wool. Some very choice clip might be sold for several cents less than its actual value because the farmer and possibly the dealer might not know the exact market price for the grades of this particular clip. Again, a clip of rather inferior, low-priced wool might be bought for more than its actual value, in order to close the deal, because the farmer might not understand why his wool would not be just as valuable as the choicer clips. This, on the face of it, may appear like a good deal for the farmer that has inferior wool, and in fact it is. But it is not good for the sheep industry to encourage the farmer who has inferior wool to continue the production of inferior wool by paying him this premium for trash. If anyone is to receive a premium, it should be the man who is producing the best of wool, but by the old system he is the one who sustains loss. In other words, the premium is paid to the careless producer who should be discouraged and the one who should be encouraged, is discouraged.

Cooperative wool marketing is, therefore, the means by which such unfair and unsatisfactory dealings can be avoided in favor of clean-cut, business-like transactions. When the farmer can get just what choice wool in worth, he will usually consider it worth while to take pains with his sheep and the shearing and preparation of his wool for market.

ORGANIZATION FOR COOPERATIVE WOOL MARKETING

The exact form of organization for cooperative wool marketing may vary all the way from a group of farmers in a community to a state federation of county sheep growers' associations. The final object should be to have the wool pool large enough to attract competent buyers and insure keen competition and spirited bidding. The principle involved is the same as for a public auction. In states where they have pooled thru a state association, they have had the advantage of dealing direct with the manufacturers, which has resulted in doing away with a large amount of unnecessary expense in getting the wool from the farm to the mill. This economy has made it possible for the farmers to get full market value at the mill, less only the freight and what it has cost their association to handle the clip. Greater economy than this seems practically impossible. However, there are some difficulties in the conduct of such a large pool, which may in time be eliminated. The chief difficulty so far as the farmer is concerned, is the fact that this method may necessitate a wait of about four to six months, but some have offered the privilege of partial payment upon delivery, and final payment when the wool is graded and sold. It is hoped, however, that the United States Wool Warehousing Act, which is now being administered by the Bureau of Markets of the United States Department of Agriculture, may help materially in adjusting this financial difficulty. The principle involved in this Act is the provision for a warehouse receipt which will represent farm products, such as wool, this receipt to be negotiable (used for cashing at the bank).

The state of Missouri is so large and varies so greatly in agricultural conditions, that at present it seems impossible for all sheep growers to be thoroly represented by a single state wool pool. The Missouri farmers are, therefore, favoring the plan of organizing in such a way as to have local, county and regional marketing. In order that this may be accomplished, community and county wool pools or county sheep growers' associations appear to be the fundamental units of organization.

ORGANIZATION FOR COMMUNITY AND COUNTY WOOL POOLS

SELECTION OF WOOL MARKETING COMMITTEE

If sheep men really want to cooperate in marketing their wool, a group of responsible and interested sheep owners may be chosen by the county sheep growers' association, by a local organization or by the county farm bureau, to be known as the wool marketing committee. To avoid an equal split in votes of the committee, it is advisable to have an odd number of members on this committee, three or five. It is important that the men on this committee be fairly well informed in regard to the handling of wool. In case there is no permanent organization to appoint this wool marketing committee, such a committee may be chosen at a called meeting of sheepmen of the community or county, and the chairman of the committee may be considered president with other members of the committee vice-president, secretary-treasurer, etc., thus having in this committee the nucleus for a wool pool department or association.

DUTIES OF WOOL MARKETING COMMITTEE

This committee should serve as an executive committee and have as its duties the appointment of a wool pool manager; arrangements for securing signed agreements from all individual growers who want to sell their wool thru the pool; advertising to dealers for bids on the wool of their pool; and to assume the responsibility for the execution of plans and conduct of wool marketing work decided upon by growers represented in the pool. It is essential that this committee be given full power to act.

COMMUNITY CHAIRMEN

A community chairman should be selected to represent each community within the county or territory of the pool where the farmers are interested in selling their wool thru the pool. It should be the duty of these chairmen to interview every sheep owner in their respective communities for the purpose of explaining the plans and possibilities of the pool and to secure signed agreements as to the number of fleeces or pounds of wool each owner is willing to promise to sell thru the pool. These signed agreements should then be promptly delivered or reported to the manager of the pool.

MANAGEMENT OF POOL

The manager of the pool should, of course, be familiar with the handling of wool and competent as a business manager, and he should receive a reasonable compensation. It should be the duty of the manager to file, list and keep on record all the agreements from growers and bids from dealers. When the wool is delivered, he should weigh and tag every sack of wool with a lot number and gross weight of the sack and keep a complete record of each grower's name, respective lot number and weight of wool. He should also receive the records of weights and values of each lot from the dealer who buys the wool and make returns to each individual grower.

In case the wool is sold by grade, the manager should keep a complete record of the weights of the various grades and corresponding values of each individual lot of wool. If the wool is consigned to a commission firm, many growers desire an advance payment on their wool and some dealers grant an advance of about seventy-five per cent of the approximate value of the wool (charge interest, at the prevailing rate, on this amount, until the wool is sold) and pay the remaining value as soon as they sell the wool. When there is to be an advance payment a sale sheet similar to the following will be found useful. Three copies will be needed for each man's record—one for the grower, one for the dealer, and one for the manager of the pool.

SUGGESTED SALE SHEET FOR A GRADED WOOL POOL

Blank County, Sheep Growers' Association

Name (Wool Grower).. Address..
Account of wool consigned (or sold) to
(Name of dealer)...Address ....
——lbs. Fine delaine, adv. pay't. @ —c $—— Selling price @ —c $——
—— " Fine clothing, adv. pay't. @ —c $—— Selling price @ —c $——
—— " ½ Blood staple, adv. pay't. @ —c $—— Selling price @ —c $——
—— " ½ Blood clothing, adv. pay't. @ —c $—— Selling price @ —c $——
—— " ⅜ Blood staple, adv. pay't. @ —c $—— Selling price @ —c $——
—— " ⅜ Blood clothing, adv. pay't. @ —c $—— Selling price @ —c $——
—— " ¼ Blood staple, adv. pay't. @ —c $—— Selling price @ —c $——
—— " ¼ Blood clothing, adv. pay't. @ —c $—— Selling price @ —c $——
—— " Low quarter blood, adv. pay't. @ —c $—— Selling price @ —c $——
—— " Braid, adv. pay't. @ —c $—— Selling price @ —c $——
—— " —————— adv. pay't. @ —c $—— Selling price @ —c $——
—— " —————— adv. pay't. @ —c $—— Selling price @ —c $——
Total..$—— Total.......................$——
Total expenses ....$——
Dues, etc. ....$——
Total deduction..$——
Expenses Final payment $——
————% Moisture shrinkage
————% Freight
————% Local expenses
————% ....
The above grades and weights are correct and satisfactory.
(Signed) ....

NOTE: There should be as many different colored sheets as there are copies made of each man's record.

SIGNING UP WOOL GROWERS

The community chairmen should proceed, as far as possible, in advance of shearing time, to sign up all interested growers within the county or territory covered by the pool. It must be understood that the agreement is to be signed in good faith and that it is an *absolute* promise.

SUGGESTED FORM OF AGREEMENT TO SELL WOOL COOPERATIVELY

The signing of the following agreement by the grower constitutes the first step to sell wool cooperatively in its proper market:

WOOL MARKETING AGREEMENT

I hereby agree to sell my clip of wool consisting of about .... pounds thru the .... County Sheep Growers' Association. It is understood that I am to deliver this clip at a specified time to a store room or loading station designated by the sales committee of the Wool Growers' Association.

It is further understood that the sales committee will market the wool to the best financial advantage of the growers. The wool marketing committee may offer the wool to local dealers, to outside buyers or consign, and an advance not to exceed seventy-five per cent of the value of the wool will be made and an interest charge of .... per cent will be charged for the same. If the wool is consigned to ....(Name of firm) .... the rate of commission is to be .... per cent, freight to be paid by the grower to the commission house.

The Association agrees to give individual grading accounts of each clip, to keep an individual record of each grower's wool, and charge against each clip pro rata per pound only such items of expense as actually and necessarily occur in the grading, storage, insurance and sale of the wool.

I agree to take .... pounds of paper fleece twine and .... burlap bags for wool to be purchased by the wool marketing committee at the best market advantage. I have .... sheep of the .... Breed.

Name...
Address..
Loading Point Preferred...

SUGGESTED FORM OF WOOL CONSIGNMENT AGREEMENT

.... County Sheep Growers' Association.

WOOL CONSIGNMENT AGREEMENT

1. I hereby agree to consign my clip of wool, consisting of about .... pounds to the .... County Sheep Growers' Association. Same to be sold to the best market advantage, under its supervision. My most convenient loading point would be ....

I further agree to deliver this clip to the loading point when requested by the Association.

2. I prefer to ship to the city of .... to the firm of .... and to have Mr. .... act as local collector, but agree to leave the final decision as to the local collector to the Association.

3. It is further agreed, that when desired, an advance payment which shall not exceed seventy-five per cent will be made at 6 per cent interest per annum.

4. The Association further agrees to have a representative present when the grading is done and to make an individual grading report on each consigned clip.

5. The commission charged by the commission houses will be .... per cent which shall include free storage for six months if desired, insurance at wool's value and all expenses incurred after the wool reaches the consignee's warehouse. The grower is to pay the freight from his loading station to the warehouse. The commission charged by commission houses can be increased only after a majority vote, at a called meeting of all growers concerned, indicates the willingness of these growers to allow such increase.

6. The Association will make a charge of ½c a pound for all wool consigned to .... (Name of town)..............., which will cover the handling items, payment of the local collector by the Association for taking in and shipping out wool, payment for expenses connected with supervising the grading of the wool, and reporting same on each clip, and other incidental expenses not mentioned here.

7. Bags and shipping tags will be furnished to the men thru .... Secretary, ... and credited to same when returned. Growers need not pay for them unless not returned to the Company.

NAME ....
Phone No. .... Address...

Return to the secretary when filled out and signed.

The above wool consignment agreement is simply offered as a suggestion for use in wool consignment in communities or counties. It can be changed to fit the individual conditions of localities. Under No. 3, it may not be advisable in all cases to advance 75 per cent. This will be governed entirely by local conditions. The rate of interest charged will depend upon the current rate in the section. Under No. 5, the charge made by the commission house will depend upon the individual arrangements drawn up with the firm which is to handle the wools. This is often 3 to 5 per cent. Under No. 6, the charge made per pound by the association will also depend upon the local conditions. This may vary anywhere from ¼ to ¾ of a cent a pound.

STORAGE ROOM

The wool marketing committee should arrange for a suitable storage room (a floored building or barn) large enough to handle and grade a carload of wool (750 to 1000 square feet floor space). A location should be secured where there will be limited danger from fire. It will be desirable for the location to be near a freight station or on a switch, since this will reduce the drayage expense.

INSURANCE

The wool marketing committee should take out ample insurance on the wool, such insurance to go into effect on the day the wool is delivered. If the wool is sold or loaded onto a freight car on the day of delivery no insurance will be necessary.

WOOL GRADER

If a wool grader is arranged for, he should be an expert from a recognized wool firm. The expense of the wool grader will have to be taken care of by the Association. The cost will be a salary of about $10 to $12 a day, plus railroad fare. On a car of wool, the cost of an expert grader would run about 1/6 to 1/5 cent a pound of wool handled. The employing of such a grader need not obligate the association to sell to the commission firm represented by the grader. It is inadvisable and impractical to secure an expert wool grader for less than carload lots, (24,000 pounds of wool for minimum weight of a 36-foot car in Missouri)."

ADVERTISING FOR BIDS

Before shearing time the wool marketing committee should secure a good sized list of wool dealers, investigate the reliability of those with whom they may wish to deal and decide on those to whom they will advertise for bids. No more than the total amount of wool promised by signed agreements should be advertised to dealers.

The following form may serve as a guide in advertising for bids:

Blanktown, Missouri,
June ——, 192—.

ADVERTISEMENT FOR BIDS ON WOOL

Blank County Sheep Growers' Association offers for sale about .... pounds of wool to be received and paid for at Blanktown, Missouri, on such three consecutive days in June or July, 192...., as may be agreed upon by the purchaser and the wool marketing committee of the above mentioned Association. The principal grades of wool in this pool are ....

....

If Possible Have Your Representative Present at the Bidding, or if impossible submit your bids by mail or wire. All bids must be submitted in writing, including confirmation of all wire proposals. All bids should be in the hands of the secretary of the Association by noon, June ...., 192..... Bids will then be opened and the highest bids posted, without naming the bidders. *New bids* may be submitted between the posting of these highest offers and four o'clock of this same day, and awards will be made upon the bids as received until the closing at 4:00 p. m.

The Wool Marketing Committee of the Association reserves the right to reject any or all bids without designation to the bidder of cause for such rejection. Failure to bid on any one or more of the lots or grades offered will be sufficient cause for rejection of bids as all wools must go to the same bidder or bidders.

The Association reserves the right to have a committee present to assist in the grading of wool as received by the purchaser. Failure to agree upon different lots of wool as graded by the purchaser shall permit withdrawal of such lots at the discretion of the owner or his representative. Wool must be weighed on scales approved by the wool marketing committee of the Association.

Remember that the bidding closes at four o'clock the afternoon of June ...., 192...., that you should have your representative present, and that the .... County Sheep Growers' Association extends to you a most cordial invitation to come.

Assuring all interested of the best of treatment and a fair showing in the bidding and in the matter of grades, weights, etc., we wish to remain,

Very truly yours,
..............................County Sheep Growers' Assn.
Per JOHN DOE, Secretary

FORM FOR SUBMITTING BIDS

Name of Bidder.. Address..
City or town .... State..

Blank County Sheep Growers' Association,
Blanktown, Missouri.

Gentlemen:

I hereby submit the following bid for the offering of your Association according to the grades herein indicated; this wool to be delivered on dates stated in your advertisement of June ...., 192..... On the basis of choice, clear wool:

Simple Grades	**Detailed Grades**
Fine	Fine delaine..
	Fine clothing..
	½ blood staple..
	½ blood clothing..
Medium	⅜ blood staple..
	⅜ blood clothing..
	¼ blood staple..
	¼ blood clothing..
Coarse	Low quarter blood..............................
	Braid..

It is understood that damaged, burry, excessively wrapped, or falsely packed wools are to be purchased upon such basis as may be mutually agreed upon at date of sale, failure to agree upon such basis to constitute rejection of the particular wools involved.

Signed..
Date ....

ACCEPTANCE OF BIDS

The consideration and acceptance of bids should be made by the wool marketing committee and the manager, or by a special committee which may be appointed to handle these particular matters. This special committee may logically consist of three persons—the manager of the pool, owner of the wool, and the purchaser or his agent. The manager and dealer should be permanent members of this special committee while the third member changes with each lot of wool as the owner acts for himself, or thru his agent as this third member. In this way each grower can be a member of this special grading committee while his own pool is being graded and at that time he will have the opportunity to reject the bid in case the grade is not satisfactory. It is recommended however, that no wool be withdrawn from the sale unless there is actual suspicion of unfair grading.

This special committee arrangement has proven satisfactory as a means of avoiding much misunderstanding. It also affords the grower an opportunity to learn from the dealer and manager, the reason for the grading and valuing of his particular clip, thus he may learn how to improve his wool and method of preparation for market. However, this plan may not be most satisfactory for very large established pools, but it is recommended for beginners in cooperative wool marketing in small, untried community pools. It may help growers to establish confidence in the pool management and wool dealers.

PAYMENT TO INDIVIDUAL GROWERS

In local pools it is possible to make arrangements whereby each grower may receive a check for total payment on his wool as soon as it is sold. The buyer should be required to make satisfactory local banking arrangements so that his check may be honored without inconvenience to the grower. A general fund should be provided to the Association from which checks for each individual grower may be drawn. Accuracy in accounting and payment is of extreme importance.

PRORATING EXPENSES

The expenses of the pool may be paid by charging a flat rate per fleece or per pound of wool sold; or by pro-rating the actual expense per fleece or per pound. Experience has shown that under normal conditions the expense has been about two to four cents a fleece, or ¼c to ¾c a pound.

CONSIGNMENT OF POOLED WOOL

Experience has shown that it is often very difficult and sometimes absolutely impossible to secure satisfactory bids on local wool pools especially when the pools are at long distances from the big wool market centers. Under conditions of this sort, some Missouri growers have consigned to reliable firms in large wool markets with very satisfactory results. In fact, some of the most satisfactory sales have been consignment sales.

Some firms have retained the consignments by lots after making returns to the pool secretary for the purpose of giving every grower an opportunity to accept or reject his returns. Dealers who buy direct often make immediate returns upon examination of the wool. Commission firms differ from dealers in that they do not usually buy the wool themselves, but simply store, grade and sell the wool to large dealers or manufacturers, thus necessitating some delay, often to wait for an advance in the market. The careful grading and market advances are of course to the advantage of the grower of good wool and many of them who have consigned to good commission firms consider this advantage well worth the wait.

When wool of the pool is consigned it will usually be advisable to ship to large dealers in the big markets. Tag every sack of wool with a lot number, sack number and gross weight of the sack. To avoid any loss of identification, make out the tags in duplicate; put one in the sack and fasten the other securely on the outside of the sack. The pool manager should attend to this at the time of weighing and should keep a complete record the same as for local sales. When possible label with black sack paint instead of tags.

Be sure the consignee is a reliable dealer or firm and have a definite understanding (in writing) with the dealer in regard to the time the wool will be paid for and the advance payment he is willing to make before consigning any wool to him. Be sure the dealer or firm will render a bill of sale specifying exact returns on weight, grade and price for each individual grower.

WOOL MARKET INTERPRETATIONS

PRICES

The wool markets of Boston and Philadelphia govern in a very large way, the wool market of the entire United States. Wool authorities of federal and state institutions report that it costs from 5 to 8 cents a pound to move wool from the farm in the central part of the United States to the Atlantic Seaboard. This would cover cost of dealers' commissions, freight, storage, moisture shrinkage, interest on money invested and preparation for sale to manufacturers in Boston and Philadelphia. The Missouri farm price would therefore be 5 to 8 cents less than the Boston and Philadelphia quotation.

GRADES

Fine and ½ blood wool is produced by purebred and high-grade Merinos and Rambouillets; ⅜ blood and ¼ blood by medium wool sheep, such as Shropshires, Hampshires, and Oxfords; low quarter blood by the coarsest of medium wool sheep, and grade coarse wool sheep, and braid by high-grade and purebred coarse wool sheep such as Cotswolds, Lincolns, and Leicesters.

Grades shown in the following table of Boston quotations are listed in the order of the fineness of the wool: "fine" being the finest; "½ blood" the coarsest of what we commonly call fine wool, that is coarser than the finest of Merino and Rambouillet wool, but finer than what we commonly call medium wool; "⅜ blood" is the finest of medium wool and "¼ blood" the coarsest of medium wool; "low quarter blood" is coarser than "¼ blood" but the finest of coarse wool, while "braid" is very coarse, in fact the coarsest of Missouri grown wools being nearly as smooth fibered and coarse as the mohair of the Angora goat.

The terms "delaine" and "staple" indicate that the wool is as long, or longer than about 2½ inches. The word "clothing" indicates that the wool is as short, or shorter than about 2 to 2½ inches.

SHRINKAGE

The estimated shrinkage is based on actual experience of scouring mills, and means the percentage, by weight, of grease and dirt that will wash out of the wool.

A SAMPLE OF BOSTON WOOL QUOTATIONS

The following table shows Boston wool quotations for June 16, 1919:

MISSOURI BRIGHT FLEECE WOOL

GRADE	Estimated shrinkage	Grease price, cents
Fine delaine	63-66 %	60 to 66
Fine clothing	63-66 %	45 to 51
½ Blood staple	56-60 %	59 to 65
½ Blood clothing	57-62 %	44 to 55
⅜ Blood staple	47-51 %	56 to 63
⅜ Blood clothing	48-52 %	48 to 55
¼ Blood staple	43-47 %	55 to 60
¼ Blood clothing	44-48 %	43 to 49
Low quarter blood	42-45 %	39 to 46
Braid	43-45 %	38 to 44

SUGGESTIONS FOR SHEARING AND PREPARING WOOL FOR MARKET

To realize full value for the wool, observe the following points when shearing and preparing wool for market:

1. Never shear when the fleeces are wet.

2. Shear on a clean, well-swept floor.

3. Avoid cutting the wool twice.

4. Remove tags from fleeces and sack separate.

5. Tie each fleece separately skin side out with paper fleece twine, not binder twine, nor rough twine of any kind.

6. Use no more twine on the fleece than is necessary. Usually two strings each way around the fleece is sufficient, and even one string each way around has proven satisfactory for medium sized fleeces which are properly shorn and rolled.

7. Separate burry, dirty, black, cotted and dead fleeces from the others.

8. Keep the fleeces of fine wool, medium wool and coarse wool separate.

9. Fleeces having a staple (length) not longer than 2 or 2½ inches should be kept separate from those having longer staples.

10. Sack the wool, or cover it with canvas or burlap and store in a clean dry place.

11. Never place fleeces on a floor strewn with chaff, straw or litter of any kind.

12. Seven-foot, and seven and one-half foot burlap wool bags will hold about 20 or 25 ordinary fleeces and are usually most satisfactory.

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UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS

University of Missouri College of Agriculture and the United States
Department of Agriculture Cooperating
A. J. Meyer, Director Agricultural Extension Service

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CIRCULAR 77 COLUMBIA, MISSOURI APRIL, 1920

Raising Pigs

F. L. Wright

Good results in feeding can be had from any of the modern lard type hogs and the breeder or feeder will very likely be greatly benefited if he raises the type and breed which is the most popular locally.

Pigs selected for feeding should first of all be healthy. The object is to get an animal which will make rapid gains at a comparatively low cost. This requires a hog of much vigor and ruggedness. Indications of these characteristics are large bone of good quality, strong arched back, smooth shoulders, deep broad chest, and an abundance of energy. Avoid pigs with extremely small, or with large coarse bone. Avoid a weak back, rough shoulders, narrow or shallow chest, and animals without vigor and energy.

A purebred Poland-China litter at about six months of age

The pig should have good length and depth. A short-bodied pig when fed heavily tends to fatten at too early an age. After an animal becomes fat, gains cannot be made as rapidly nor as economically as before such a high condition is reached. Depth of body is necessary in order to secure good digestion. Narrow, shallow-bodied animals will not consume enough feed to make rapid gains.

Quality in the pig is very important. This is easiest to find in animals having a high percentage of pure blood. Purity of breeding insures that the pig comes from ancestry selected and developed for the characteristics desired in the fattening hog.

CARE OF SOW AT FARROWING TIME

There is no period of the year when time spent looking after the swine herd will pay as well as at farrowing time. By neglecting the sow then a club member may undo all that he has previously accomplished thru care and attention, since in a great many cases it is not so much the number of pigs farrowed as the number raised that counts.

Where the sow has been handled quietly and well cared for, she should be easily managed during farrowing. Since the number of pigs she will raise depends a great deal upon her disposition any extra care given is time well spent.

Strict account should be kept of breeding dates, and about a week before time for her to farrow the sow should be placed in a pen by herself so that she may become accustomed to the place and not be restless. The amount of bedding provided also has considerable to do with results at this time. The amount should be moderate. It is easier to supply too much than not enough. The place in which the sow is to farrow should be warm enough that a great amount of bedding will not be needed. When too much bedding is used, the pigs are apt to get down into it and, hidden from the sow, may be smothered or crushed. A bushel or so of wheat chaff or cut straw is good. After the sow farrows do not be too eager to supply more bedding until after a day or two. The bedding may be changed but the amount need not be increased. The main thing is not *much* bedding but *dry* bedding, therefore it will have to be changed more often because of the smaller amount used.

When possible the sow should be placed where she will not be bothered by other hogs at farrowing time. Individual houses are of value at such times. Usually the less the sow is disturbed the better. It is important that one should be on hand, but unless she needs assistance, she should not be disturbed. If the sow needs assistance, be as quiet about it as possible. It is essential that the pigs do not become chilled before they have dried off, and have suckled. If the weather is cold, a lantern hung in the top of an individual hog house is sufficient to take off the chill. At such times, it is well, if the sow is gentle, to take each pig away from its mother as soon as it is farrowed, and place it in a box containing some hot bricks covered with old sacks. The pigs may be left here until well dried off and lively enough to put with the sow. If the pigs do become chilled, there is no better way to revive them than to dip them in warm water. This will often serve when other means fail.

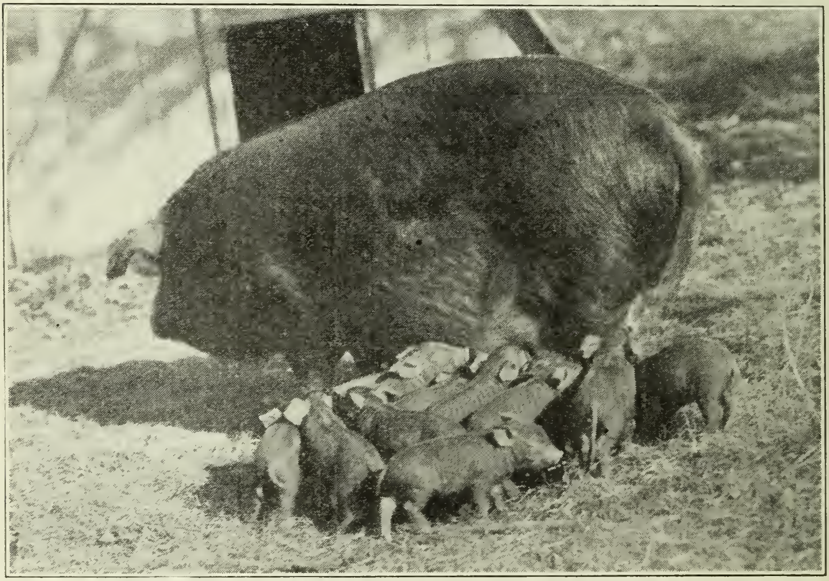
The sow should be fed but little for twenty-four hours after farrowing. She should not be disturbed, and if she lies quietly for ten or twelve hours or even more, so much the better. Great care should be exercised during the first three days not to overfeed. In fact, the inexperienced person will more often give the sow too heavy than too light a ration. The pigs are not able to take much milk so the milk flow should not be stimulated for the first few days. The sow will be in a more or less feverish condition, for which reason she should have all the water she will drink but no feed for a day or more. If the weather is cold, it is well to take the chill off the water. The first feed given should be the same as the sow received before she farrowed and should be fed in a small amount as a thin slop. The feed may be gradually increased as the pigs become able to take the milk until the sow is getting all she will eat of a good, laxative, milk-producing feed. Ordinarily about two weeks should be taken to get her on full feed. After the pigs are old enough to take all the milk the sow can produce, she should be liberally supplied since there is no better way of feeding than thru the mother.

FEEDING AND CARE OF YOUNG PIGS

The three essentials for success with young pigs are: Feed, sunshine, and exercise. If these three things are looked after carefully much will have been accomplished.

Feeding the pigs before weaning.—The fastest and cheapest gains are made on a pig before weaning time so ordinarily it will pay to keep the small pig growing as rapidly as possible. The sow should, of course, get some good milk-producing feed and she should be fed to full capacity as soon as the pigs are old enough to take all the milk she will give. It will not pay to limit the feed at this time since the pigs make the most economical gains from feed fed thru the sow. When the pigs are about a month old, they will be able to use more feed than that obtained from the sow even tho she is properly fed and is a good milker.

As soon as the pigs will eat, which is usually at three to five weeks of age, they should be fed separately from the mother. A creep of some kind should be made for them, that is, they should have access to a small pen where the sow cannot go, to receive their feed. Skimmilk fed in a shallow pan is very good for them. The pigs may also be taught to run into the creep for feed by allowing them some shelled or ear corn. As soon as they begin to eat well, a slop made of milk, some shorts, a little bran and some linseed oil meal or tankage fed along with the corn, will make a ration which with proper exercise will not cause thumps or scours.



A good mother and a strong, healthy litter. These pigs have received a good start in development

A good ration for young pigs is:

Corn	4 parts
Shorts	4 parts
Tankage	1 part

The proportions should be by weight rather than measure. As the pigs become older the corn in the foregoing ration may be gradually increased until the amount has been doubled.

In addition to proper feed the pigs must also have plenty of sunshine and exercise. These cost little but are absolutely necessary for the best results.

Perhaps the most common troubles caused from lack of proper attention to the feeding and care of pigs are scours and thumps. Scours are usually caused by one of four things: Changing the feed of the sow, overfeeding, dirty pens and troughs, or exposure of either sow or pigs to cold rain or cold weather in such a way that they become chilled.

Since the cause of scours is something which causes indigestion, the thing to watch especially is the feed. Changing from sweet to sour milk often causes the trouble, as will also the feeding of too much high protein feeds such as tankage or linseed oil meal when the animal is not used to it. If the sow is fed too much her milk flow is so stimulated that very young pigs will get more than they can utilize, thus causing them to scour. Pigs should always be in dry, clean quarters and be fed in clean troughs. They should not be allowed to run out in cold rain or allowed to become chilled in any way. Sows running thru filth and then being suckled by pigs, will often have pigs which scour.

These pigs, from the same litter shown on the opposite page, show the importance of good care given the sow and pigs at farrowing time

There are a good many remedies used for this trouble. The first thing to do is to cut down on the sow's feed and clean up her quarters if they need it. A tablespoon of sulphur in the sow's feed for two days is also good. If the sow is given a good physic such as Epsom salts, good results will follow. Scalded milk is also a good remedy. Each pig may be given a good physic as a teaspoonful of castor oil or Epsom salts. Charcoal is good.

Thumps often occur in young pigs and is the result of lack of sunshine and exercise, along with high feeding. The remedy is, of course, to cut down the sow's feed and force the pigs to take exercise in the sunshine. Thumps may also occur in large pigs after they are weaned, but when old pigs have it, it is usually caused by some affectation of the lungs or bronchial tubes.

Never feed pigs table scraps containing tea and coffee grounds or orange peel. They are poisonous. Also, be very careful not to allow broken glass, washing powders, soaps, or any other materials of that nature to get into the feed. Always mix slops that will pour easily—not too thick, and not too thin.

Arthur Gwinn of Livingston County, champion pig-club boy, 1919

CARE AND FEEDING OF PIGS AFTER WEANING

Care.—After the project is started attention should be centered on three main factors: sanitation, exercise, and feeding. Sanitation has to do with the measures taken to preserve the health of the animal. Cleanliness is the essential feature. Dirty surroundings probably lead to more disease and trouble than any other cause. Pigs should have dry comfortable surroundings, with clean bedding and should be fed in clean troughs on clean floors or on pasture.

Exercise.—Exercise is essential to best results especially before the pig has reached a weight of 100 to 125 pounds. Lack of exercise not only may injure the health of the animal but may result in its becoming fat at an early age and thus reduce the rate and economy of gains later on. At the beginning of the feeding period the pig should be induced to grow rather than to fatten.

Feeding.—In order to get the best results in feeding pigs, it is necessary to feed a balanced ration. A satisfactory ration is one that meets the following requirements: It must be a feed that the pig likes, and must contain all the materials necessary for growing everything which goes to make up the body of a young pig. It must keep the body warm and supply energy for muscular exertion, as well as produce fat.

The common cereals such as corn, oats, rye, barley, etc. do not make balanced rations for pigs. They contain plenty of carbohydrates but do not contain sufficient protein and mineral matter. Carbohydrates include starches, sugars, fats, and oils. These furnish heat, energy, and fat for the body. Protein and mineral matter are necessary for making bone, muscle, hide, hair and to aid in digestion.

Rosa Vaughn, Martin City, a member of the Longview pig club, 1919

The following mixtures as rations are good for pigs running on pasture:

No. I

Corn	6 pounds
Shorts	3 pounds
Linseed oil meal	1 pound

No. II

Corn	9 pounds
Shorts	2 pounds
Tankage	1 pound

No. III

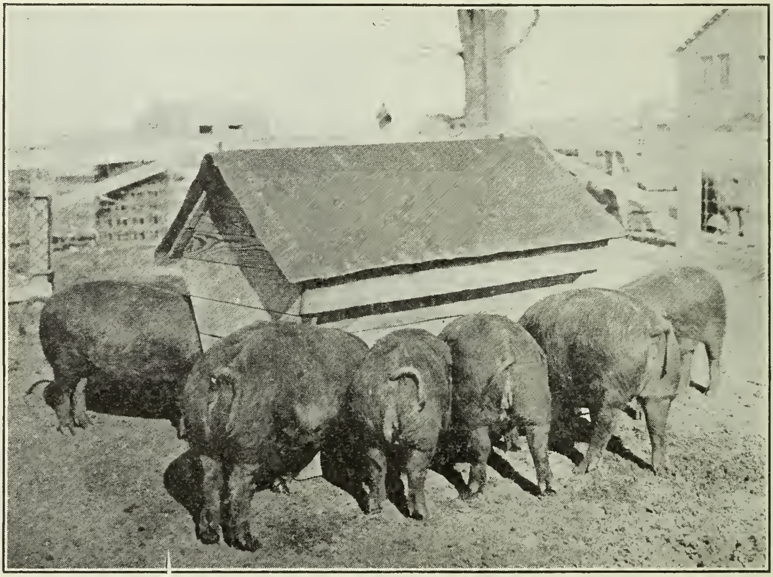
Corn	1 pound
Shorts	1 pound

No. IV.

Corn	10 pounds
Tankage	1 pound

Skimmed milk or buttermilk added to any of the foregoing rations may take the place of a part or all of the tankage, oilmeal or shorts. It requires about three pounds of skimmed milk or buttermilk to balance one pound of corn. It is advisable to use skimmed milk or buttermilk whenever you can. Use home grown products as much as possible. *Do not feed corn alone to pigs.* A hog likes variety of feeds. Do not handicap your pig by putting it in a small pen and feeding it corn only with dirty water to drink. Give it pasture range, a variety of good wholesome feeds and plenty of pure water.

Self feeders.—A simple and effective method of fattening hogs is by means of the self-feeder. By self feeding is meant allowing pigs to eat at will of one or more feeds supplied in a specially constructed feeder. It consists of a hopper to hold the feed and a trough below into which the grain flows as the pig eats. It should be divided into compartments so that two or more kinds of feeds may be fed at a time. If given a chance pigs will balance their own ration. Shelled corn and tankage in separate compartments make a very satisfactory ration for fattening hogs. Club members who so desire can make their own self-feeder. Missouri Agricultural Experiment Station Bulletin 144 contain-



A self-feeder will save labor and make economical gains ing directions for constructing a self-feeder will be sent on request.

PASTURES FOR HOGS

Pastures afford best conditions for pigs as regards both sanitation and exercise. Foraging compels the pigs to take exercise. It keeps them in the open air surrounded by the clean conditions of the field and growing crops. Good pastures for young pigs will often increase the efficiency of a grain ration as much as one-third. Therefore the pig club member who expects to make economical gains must provide good forage for his animals.

Clover and alfalfa stand at the top of the list of forages for summer use. Rape or a mixture of rape and oats makes a very good substitute. Bluegrass and white clover make one of the best permanent pastures. The use of bluegrass, timothy or oats alone is not as good as those previously mentioned, but is valuable. For late summer and autumn soybeans is very satisfactory. Rye is a good winter pasture. Do not pasture alfalfa closely. It should be at least one year old before being pastured. Ten or twelve pigs to the acre will not injure the stand. When alfalfa becomes ragged it should be clipped with a mower and the hay removed. Frequent changing from one field to another prevents the destruction of the alfalfa and provides fresh pasture. Pasture red clover carefully to prevent the killing of the plant. Frequent changing will keep the pasture fresh. An acre should take care of ten pigs.

Pigs on rape pasture

Dwarf Essex rape, sown at the rate of five pounds per acre, in small fields, will supply an abundance of forage. It can be sown as early as April and as late as July providing there is sufficient rainfall. Begin pasturing when the rape is ten or twelve inches high. If two or more plots are sown they will provide a succession of fresh pasture thruout the summer when the bluegrass is short. Rape will stand considerable freezing, therefore, it may be pastured late in the fall. If not eaten too closely it will come again, replacing its original growth two or three times during the season. Oats and rape in the proportion of four pounds of rape to sixteen pounds of oats sown April 1 to 10 make good summer pasture.

Sorghum grows well on thin land and makes good pasture during July, August and September, when the bluegrass is generally short. It can be sown about corn planting time.

Soybeans make a good legume forage plant and may be sown from May to July according to the variety.

Rye sown in August and September and wheat in October are good winter and early spring pasture for the brood sow and her litter.

SANITATION

The greatest drawback to the hog industry in this country is found in the losses thru outbreaks of hog cholera, and thru the development of tuberculosis. In dealing with the diseases of hogs preventive measures must be relied upon. It is much easier to prevent a disease than it is to cure it. For the maintenance of health in all animals the food and water supply should be of good quality and free from disease-producing germs.

Contrary to common belief the hog is naturally a clean animal. Unless compelled to do so, a hog will not sleep in its own filth. If part of the floor of the pen is raised and kept well bedded with straw, all excrement will be left on the unbedded portion of the floor and the bed will be clean.

Lice.—The hog louse is one of the most common causes of poor condition of young pigs. It is advisable and profitable to keep swine free of lice at all stages of their development. To this end their houses, pens, and sleeping places should frequently be cleaned and disinfected, the woodwork whitewashed, the bedding material kept fresh, clean and dry. The yards should be kept free of litter and filth. It is impossible to keep hogs free of lice without keeping the quarters sanitary.

As a remedy for lice, crude oil has proved very satisfactory.

It may be applied with a spray, sprinkler, brush, or as a dip. A quantity of crude oil poured in the wallowing hole will allow the hogs to oil themselves. The animals in wallowing should get sufficient oil on them to destroy the lice. By keeping this arrangement in operation the hogs can be kept free of lice without any worrying or handling. Other methods of ridding hogs of lice will be found in the bulletins you will receive.

Intestinal worms are common in hogs and especially injurious to growing pigs. You will receive Missouri Extension Service Circular 13 which will give you instructions in ridding your pigs of worms.

A good tonic for keeping your pigs healthy is: 1 quart of wood ashes, 1 quart of charcoal, ½ pound of salt, ¼ pound of sulphur, and ¼ pound of pulverized copperas. By supplying the pig with this mineral matter, you can keep him from rooting, and he will put on more flesh. You can put this mixture in a small box convenient to the pig. This mixture is important because it builds the bone and frame of your pig, aids in digesting his food and sharpens his appetite.

The main thing, however, in feeding is to do it regularly and carefully, keeping a close watch on the progress the pig is making. It is always a good thing to vary your feed a little to keep him eating well, and in this connection it may be mentioned that green feeds are excellent to keep a pig in shape, altho one must not feed them in too great a quantity at the start.

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CIRCULAR 78 COLUMBIA, MISSOURI MAY, 1920

Saving the Summer Egg

T. S. Townsley

One of Missouri's greatest problems in food conservation is how to maintain the quality of the summer eggs. When eggs are laid they are sweet, clean, wholesome, and agreeable to the most delicate taste. They are one of nature's choicest food products, but they are also a perishable product. By the time they reach the consumer, a large number of eggs are no longer attractive in appearance nor palatable in flavor, but have so far deteriorated as to be unfit for food. The annual loss caused by egg spoilage in Missouri is estimated at $5,000,000. This occurs mostly in summer and is largely preventable.

ROOSTERS CAUSE EGG SPOILAGE

By far the largest part of the summer loss is found in fertile eggs. The fertile egg is one which, if given the proper heat, is capable of producing a chick. This class of eggs is very hard to handle in hot weather without heavy losses. Marketing conditions in Missouri are such that considerable time is required to get the egg from the nest on the farm to the cold storage plant in the city. It is during this interval that the loss occurs. A fertile egg will incubate at any temperature above 68 degrees, and one held at 85 to 90 degrees for three days will show as much chick development as for one day under a sitting hen, while one held at 104 to 110 degrees for one day will show as much chick growth as for three days under a hen. During the summer on many farms it is impossible to find a room that will be cool enough to prevent fertile eggs incubating. When the eggs are held on the farm for a week or more at summer temperatures considerable chick development will take place it fertile eggs. Investigations show that at least two-thirds of the egg losses occur on the farm, but the huckster wagon, the country store, and the hot freight and express car also cause heavy losses in fertile eggs. The roosters in the flock are responsible for all the losses caused by chick development and for most of the loss from rots. The remedy is simple. Get the roosters out of the flock before hot weather sets in. If this is done the loss in bad eggs will be less than half as great.

MANAGEMENT OF MALES

The male has no beneficial influence whatever on egg production. The only reasonable excuse for his existence is to fertilize eggs for hatching. It costs as much to feed a rooster as a hen and the male pays no returns whatever except during the hatching season. Only enough males should be kept thru the winter months to mate with the hens needed to produce eggs for hatching. A breeding flock, consisting of the best hens on the farm, should be made up in the spring and mated to the best roosters obtainable. No more hens than are needed to supply eggs for incubation should be put in the breeding flock, and the hens laying eggs for market should never come in contact with a male bird. As soon as the season for setting eggs is past, which should not be later than May 15, the males should be separated from all hens so that only infertile eggs will be produced during the summer months.

"CAN" THE ROOSTER

The annual loss from bad eggs amounts to about $20 on the average Missouri farm. The rooster is responsible for most of this loss and it occurs at a time when his presence in the flock is wholly unnecessary. He eats high-priced feed during the summer and lowers the quality of the eggs without producing any benefit. He stands indicted as a foe to conservation and should be "canned" out of the flock. To kill, sell or confine all roosters as soon as the breeding season is past is the greatest move toward saving the summer egg. All roosters which are not to be used another season should be sold or killed. Those valuable enough to serve for the next breeding season, may be confined in a small yard without any harm to the roosters. With some breeds the early hatched cockerels may develop enough to fertilize eggs before the end of the hot season. To prevent this all cockerels should be disposed of before they reach sexual maturity, or should be reared at a sufficient distance from the laying hens that they do not mingle with them. This gives the young male a better chance to develop and prevents fertile eggs. Pullets should also be separated from cockerels as they will develop more uniformly if not constantly annoyed by active cockerels.

OTHER CAUSES OF LOSS

Aside from the losses resulting from the sale of fertile eggs, a further preventable loss is caused by cracked eggs, dirty eggs, shrunken eggs, and bad flavored eggs.

Cracked or broken eggs are caused by thin shells and careless handling. The thin shelled egg can be largely prevented by giving the hens plenty of exercise and seeing that they are provided with a liberal supply of lime in the form of crushed oyster shell. Eggs are often broken in the nests, either by the hen dropping them on to the bare nest bottom or by hens crowding in the nests. A nest should be provided for every six hens and the bottom be kept covered with straw, to prevent these troubles. In gathering eggs, a basket or bucket with some soft material in the bottom should be used. In packing eggs to send to market the bottom of the basket or box should be lined with soft material, or the eggs should be packed in cases, using straw board fillers with plenty of padding at the top and bottom of the crate.

Dirty eggs spoil quickly, due to the ease with which bacteria can pass thru a dirty shell. Washing the eggs destroys the protective covering and causes them to spoil more readily. Special care should be used to reduce the number of dirty eggs by keeping the nests clean and the poultry yards dry. The straw in the nests should be changed as soon as it begins to soil the eggs; and the nests should be closed at night to prevent the birds roosting in and fouling them. Dirty eggs are all right for immediate use but should be served at home instead of being sent to market.

Shrunken eggs are those showing a very large air cell. This results from heating or holding the eggs too long before marketing. Part of this loss comes from selling infertile eggs from the incubator. Allowing broody hens to sit on eggs for several days before gathering also causes shrinkage. Holding the eggs to secure a full basket or crate or waiting for the price to go up is another cause of shrunken eggs. This loss can be prevented by gathering the eggs every day, by making sure that none from the incubator or sitting hen is sold, by storing in a cool place, and by sending the eggs to market regularly twice each week. A dry basement or a well-ventilated cyclone cellar makes a satisfactory place to store eggs on the farm, or they may be kept cool by placing in a bucket and lowering them into a well.

Bad flavors in eggs result from mold, absorption of odors and improper feeding. A mold which develops when the eggs are kept in a damp, musty place imparts a bad flavor. Eggs that are kept close to onions, cabbage, or kerosene absorb the odors of these materials.

Feeding such things as onions will also give an unpleasant taste to eggs. This loss can be prevented by keeping the eggs in a dry place, away from offensive odors, and by feeding only desirable materials. The egg basket should always be covered to keep of dust and flies.

RULES FOR PREVENTING LOSS

1. "Can" the rooster at the end of hatching season.
2. Provide a clean nest for every six hens.
3. Feed crushed oyster shells to hens.
4. Gather every egg each day.
5. Keep eggs clean, cool, and dry.
6. Market eggs twice weekly.
7. Eat all large, small, dirty, or cracked eggs.
8. Sell no eggs from incubators or stolen nests.
9. Pack eggs so they will not break.

SELLING GOOD EGGS

In too many communities, eggs are bought on the case count or ungraded basis. By this system all eggs, good or poor, are purchased at the same price. The result is that the price is low because the buyer must protect himself against the losses from low-grade eggs. This offers very little encouragement to the farmer to produce good eggs, because he gets no pay for his extra care. If possible the dealer should be persuaded to buy on a graded basis, paying different prices for eggs according to their quality. If the local buyer does not favor this system the farmer should find a different market. In many localities it is possible to sell good eggs to hotels, restaurants, soft drink parlors, and dealers in fancy groceries, at a premium above the general market. If a good market can not be found near home, the producer can find a commission dealer or a poultry packer in the large cities, who will pay a higher price for quality eggs and it is usually profitable to send thirty-dozen cases to such dealers, by express. If all the farmers in a community would produce good eggs the local dealer could pay a better price to all. There is always a good market for good products.

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CIRCULAR 79 COLUMBIA, MISSOURI JUNE, 1920

Colds---Their Causes and Treatment

Mrs. Louis Selbert

The condition known as a cold is caused by a disease germ growing in the body. We are always taking germs into the body, either by breathing air into which some one has sneezed or coughed, by kissing someone with a cold, or by carrying germs to our mouths on our hands or food. The germs do not grow if we are in good health, because healthy blood contains substances which prevent the growth of the disease germs. When the body is not normal, then the germs which have settled in the nose or throat grow and cause inflammation. The more poisonous the germ and the lower the body's strength, the more severe will be the inflammation. Those persons who have enlarged tonsils or adenoids are more susceptible to colds and usually have more severe ones.

The following factors lower the resistance of the body so that cold germs are apt to grow:

1. *Lack of sufficient sleep to repair the body.*—To keep in good health one should get at least as many hours of sleep as are indicated for the age in the following table:

Hours of Sleep for Different Ages

Age	*Hours of Sleep*	*Age*	*Hours of Sleep*
1st month - -	18 to 20 hrs.	8 to 10 years - -	11½ hrs.
2 to 6 months -	16 to 18 hrs.	10 to 12 years - -	11 hrs.
6 to 12 months	14 to 15 hrs.	12 to 14 years - -	10½ hrs.
2 years - - -	13 to 14 hrs.	14 to 16 years - -	10 hrs.
2 to 5 years -	11 to 12 hrs.	16 to 18 years - -	9½ hrs.
5 to 6 years -	13 hrs.	18 years - -	8 hrs.
6 to 8 years -	12 hrs.		

2. Constipation.—If the wastes of the body are not removed regularly, poisons are formed and circulate in the body, causing a feeling of dullness and fatigue and lowering of its resistance to disease germs.

3. Indigestion.—The habit of eating rapidly, of eating food difficult to digest, or of eating heavy foods while tired or worried, may weaken the body so that such a person will take cold more readily.

4. Lack of fresh air.—The oxygen which is taken into the body when pure air is breathed, passes into the blood and displaces impurities which are then thrown out of the system. Sleeping out of doors or in well-ventilated rooms supplies the blood with the oxygen which is needed to keep the body in good condition. If dust is inhaled the linings of the nose and throat become irritated. Disease germs are often carried into the body on dust.

Some of the symptoms of a cold are: Inflamed lining of the nose and throat; inflamed and watery eyes; fever, aching body, hoarseness, dry lips, loss of appetite or other disturbances. The so-called cold may be the only sign of the start of some serious disease as measles, whooping cough, diphtheria, scarlet fever or influenza.

TREATMENT FOR A COLD

Keep the bowels open.—Give a laxative even if the patient isn't constipated; 1 ounce of castor oil, or 1 teaspoonful of compound licorice powder dissolved in a half-glass of water, or some other mild remedy is best. If the drug does not act in six hours, insert glycerine suppository, or wash out lower bowels with salt water (one teaspoonful clean salt in one pint of boiled water).

Stimulate the patient's skin.—This is necessary in order to get impurities out of the body thru pores of the skin and to help relieve congestion. Give hot bath then roll in warm blanket and allow to perspire for one hour (putting cold compress to head), then sponge with tepid water. Do not permit patient to lie in draft, or get chilled while being rubbed or bathed. If the room is cold then bathe the patient under cover of a blanket. Place a bath towel under each part as you wash it. Remove the blanket after bathing and replace with the bed clothes without exposing the patient.

Keep patient in bed until temperature is normal.—This is necessary so as to prevent him from chilling and weakening himself and to protect other persons. If the patient complains of being cold, a hot water bottle may be put to the feet or back or over stomach. If a rubber bag cannot be obtained, a jug filled with hot water, a heated iron, or a warmed brick or a soap stone may be put into the bed.

Have patient breathe pure air.—Guard against drafts; but do not have temperature of room above 70 degrees. Partial ventilation may be secured by fitting a board or a piece of window glass 18 or 20 inches wide upright inside the lower sash, which may then be raised behind it. Covering the wire window screen with a cheese cloth or very thin flannel will allow the entrance of air without draft. To ventilate the sick room quickly and thoroly, an open umbrella may be placed with the handle at the patient's side and the edge of the umbrella resting behind the pillow, the whole covered with a sheet or thin blanket while all of the windows and doors are opened for five minutes.

Decrease diet to one half.—If fever is over 101, reduce amount of food given to one-third and give fluids only. Have patient drink water freely in addition to taking such fluid nourishment as milk soups, hot milk or cocoa, egg shake, etc.

Keep mouth clean.—Teeth, gums and tongue should be cleansed several times each day and always rinsed after taking nourishment. If lips are dry, they can be kept from cracking by applying solution of glycerine and lemon (half ounce of glycerine in juice of one-fourth lemon).

If lining of nose is sore, or if nose is clogged, have patient lie on back and squirt into his nose from a medicine dropper the following mixture: Menthol one grain, Glymol one ounce. About one-fourth of a dropper full in each nostril is enough. This may be repeated every four hours. If the Menthol is not at hand, the oil alone will be helpful. Alboline, Stanolax, Nujol, or Liquid Vaseline may be substituted for Glymol.

TO TREAT EARACHE

Earache often follows cold in the head and it is much more likely to occur if there are adenoids, large tonsils or other obstructions of the nose and throat. Heat should be applied to the ear either by means of a hot-water bottle or by hot cloths, or by irrigating the ear with hot salt water (one teaspoonful of clean salt to one pint of hot water). This should be as hot as the patient can bear it. For very young children, a few drops of warm water dropped into the ear from a medicine dropper will usually stop the ache. To irrigate the ear of older children or adults, hold the lobe upward and backward if the patient is an adult, and downward and backward if the patient is a child. Owing to the lack of development of bones in the young child, the canal of the ear cannot be reached unless it is held in this manner. Hold basin under ear to catch fluid as it flows out, or have patient hold head over bucket or basin. Place can or bag containing fluid only one foot above the ear while fluid is flowing so that the fluid will flow in gently. Have soft rubber nozzle on end of tube from can to ear, or use glass part of medicine dropper for irrigating point. Do not obstruct canal with nozzle, for the fluid must escape as quickly as it enters to prevent pressure on the drum. Dry the ear with cotton after irrigation and insert small amount of cotton. Leave the same in ear for a few minutes.

A mixture of glycerine and pure carbolic acid is very comforting for adults and older children who suffer from earache. The strength of the mixture should be one drop of carbolic acid to 20 drops of glycerine. (This may be bought in the drug store under the name of 5 per cent Carbolated Glycerine). This should be used with a medicine dropper or it may be dropped directly from the bottle. Insert a small amount of cotton to keep the drug in the ear.

The treatment suggested here should only be applied if there is no discharge from the ear, never after that. The patient must be taken to the doctor if the pain continues. There is no home treatment for a discharging ear except that which the doctor has ordered for the individual.

Gargles are of some use in fighting a cold. To be effective, they must be taken just as hot as the patient can bear in comfort. The hot weak salt solution is as good as any gargle and may be repeated every 3 or 4 hours. It is better than most patent antiseptic gargles.

RESULTS OF COLDS

1. After the germs have gained entrance to the body, they may be carried by the blood to various organs, producing heart disease, kidney disease or inflammation of the joints.
2. Enlarged adenoids are often the result of repeated colds, but if they are once established, they invite more colds.
3. The common cold, especially in the case of a baby, may result in an ear abscess.
4. Digestive disturbances often follow a cold. The diet should be especially light but very nourishing for several weeks after the infection.

STOP THE SPREAD OF COLDS

1. Cover your mouth or nose when you cough or sneeze.
2. Spit into paper or a rag to be burned at once or placed in paper bag to be burned later; or into a handkerchief. Never spit on the street or floor.
3. Wash your hands after using your handkerchief, before touching food, a baby, books or magazines that others will use.
4. Tie a piece of cheesecloth or other material over your mouth and nose before handling baby or preparing food if you have a cold.
5. Boil separately, and hang in sun, handkerchiefs of those who have colds. Such handkerchiefs are more easily washed if they are first soaked in cold salt water.
6. Avoid sleeping or staying in closed room with others when you have a cold and do not go to public gatherings unless it is absolutely necessary.

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UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS

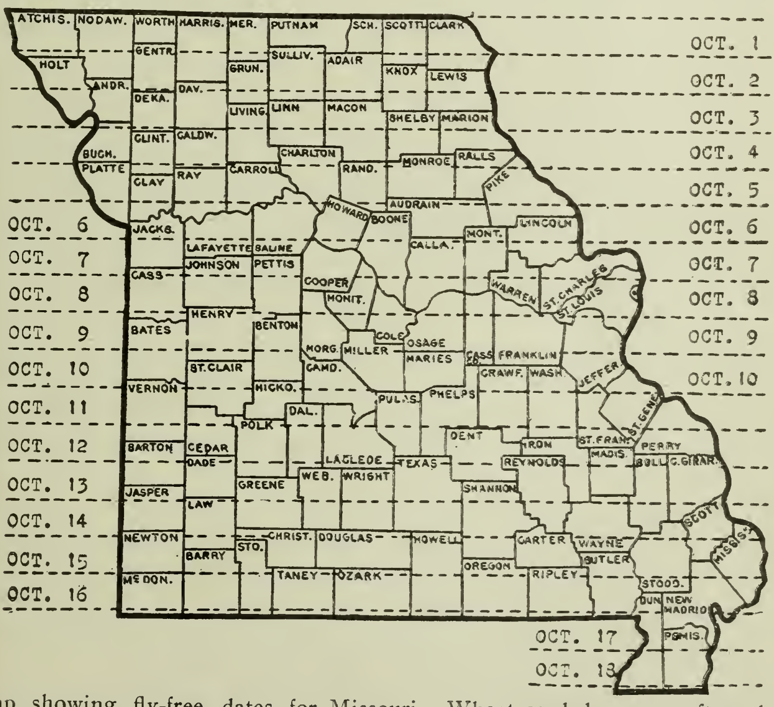
University of Missouri College of Agriculture and the United States
Department of Agriculture Cooperating
P. H. Ross, Acting Director Agricultural Extension Service
Distributed in furtherance of the Acts of Congress of May 8, and June 30, 1914

CIRCULAR 80 COLUMBIA, MISSOURI JUNE, 1920

The Hessian Fly and Its Control

L. Haseman

The Hessian fly is again present in destructive numbers, especially in the southern counties of the state. In 1916, it destroyed six million bushels of Misssouri wheat. With this immense loss still fresh in the memories of our wheat growers, it is but natural that they should be anxious to prevent similar losses. The more practical questions



Map showing fly-free dates for Missouri. Wheat seeded on or after these dates will escape fall fly injury.

asked by wheat growers are repeated and answered in this Circular.

How can one detect the fly?—The adult, winged fly, which is seldom seen by the wheat grower, resembles a very small mosquito. The female fly lays her eggs on the surface of the blades and later they hatch and the small maggots go down behind the leaf sheath where they feed. The maggot is soft and green or cream-colored. When full fed, the maggot changes to the flax-seed stage. This is what the farmer usually finds either in the young plant or in the stubble at harvest time. It is brownish in color when fully developed and is the size and shape of a flax seed. As many as fifty of these flax seeds may develop in a single plant. From this stage later emerges the fly. The maggot or "flax seed" behind the leaf sheath is often incorrectly spoken of as the egg, but the egg is a small reddish object fitted neatly into the grooves on the surface of the blades. A badly infested plant remains dwarfed, with but a few short, thick straight, deep green leaves. Pull down the blade and its sheath and the maggots or "flax seeds" will be found tucked away behind it. The spring brood causes lodging due to a weakening of the straw just above a joint. Carefully pull away the dry sheath from the stubble and the "flax seed" will be found often fitted into a depression in the straw.

How many broods are there a year?—In Missouri there are two important broods of flies each year. One appears in September and early October, the other early in the spring. These two are responsible for the main damage. Besides these two broods there may be a light secondary fall brood late in the fall, a light secondary spring brood just before harvest, and a summer brood. These are of little consequence and will not cause serious trouble if the two main broods are properly controlled.

How and when does the pest damage wheat?—It is while the Hessian fly is in the form of a maggot that it does all its damage. After it goes down behind the leaf sheath it works on the wheat stem and feeds on the plant sap. The irritation and loss of sap weakens or kills the plant.

The damage to the crop begins with the young wheat in the fall. The flies of the fall brood lay eggs which produce maggots and these damage the young plants. In experimental fields last fall the damage was so great on early seeded wheat that scarcely a green blade could be found in late November. The big damage is done in the fall on young wheat and again after growth starts in the spring.

Is wheat stubble left unturned in young clover meadows or elsewhere a source of danger?—The Hessian fly passes the summer in the "flaxseed" stage in stubble, and all infested stubble which is not plowed under soon after harvest will give off adult flies later. The majority of the healthy "flax seeds" in the stubble give off flies in the fall and only occasionally will one carry thru the winter and give off the adult fly in the spring. Infested wheat stubble in young clover meadows is a fall menace to wheat but of no importance the following spring.

Should badly infested wheat be plowed under?—This very common question can not be answered with any degree of satisfaction. Even after carefully going over an infested field it is not safe to recommend plowing under. It is remarkable how badly a field may be injured and yet with favorable conditions come out and make a fair yield. This is especially true in case of fall injury. One should be absolutely certain the pest has ruined the crop before he is warranted in plowing it under. However, when he is certain the crop is gone he should not permit it to stand and give off flies for further damage to other fields of wheat. Plow it under deeply and work the ground to prevent the emerging of adult flies later. Occasionally a wheat grower in the fall will reseed an early sown field of wheat that has been destroyed by the fly without first plowing under the infested plants of the first seeding. This is folly, for the pest will pass the winter on the injured wheat, appear as flies in the spring and deposit eggs on the plants of the second seeding with the result that the crop usually is a complete failure. The same thing occurs where one farmer seeds early and another after the fly-free date. When spring comes, the flies from the early seeded field infest the field seeded properly.

How and when can the pest be controlled?—Four lines of work carefully carried out will rid any region of the pest in one year. These include first, the plowing under of all infested stubble soon after harvest; second, the working of the ground to firm it and prevent the growth of volunteer wheat; third, seeding wheat on or soon after the fly-free date; fourth, securing the cooperation of all wheat growers in the vicinity. But the question is raised, can this be done? Yes, it can and has been done in Missouri over entire counties. In 1916, Madison County was heavily overrun by the pest and most fields of wheat scarcely made seed. Following harvest the wheat growers got together and carried out the foregoing treatments almost to a man and the 1917 crop was completely saved from injury.

Plowing under stubble.—Clover and grass seeded with wheat will prevent the turning of some stubble but all infested stubble that possibly can be, should be plowed under six to eight inches preferably in July. Follow this with a drag, harrow or disk to close up crevices and level the soil. Very few flies will be able to emerge from the soil if the work is carefully done.

Keeping down volunteer wheat.—Some of the stubble will not be plowed under, so some flies are sure to emerge later. If volunteer wheat is kept down these will find no wheat plants on which to lay eggs when they come out and will die without leaving offspring. The cultivation will also put the seed bed in the best possible shape for seeding wheat later.

Seeding on fly-free date.—Some wheat growers object to this remedy for the fly, on the ground that the fly-free date is too late to seed in their vicinity. Since 1914 the Department of Entomology, University of Missouri College of Agriculture, has maintained experimental fields thruout the state for the study of the fly and its control. The results of these experiments show that where the seed bed is properly prepared and the soil is suited for wheat growing, the fly-free date is not too late for seeding wheat in Missouri. In the experimental fields seven plots were seeded at intervals of one week, three before, one on and three after the fly free date. The records of yield show that the plot seeded one week before the fly-free date, the one on the fly-free date, and the one seeded a week after the fly-free date give the greatest average yields and the average yield from these three seedings is practically the same.

The fall brood of flies in any locality has a definite period for emerging, laying eggs and dying. If the seed does not go into the soil until the last of the flies are dead, there can be no fall brood of the pest to attack the crop later. The fly-free date for each county as determined by the field experiments is shown on the fly-free date map of Missouri.

Cooperation is necessary.—The small winged fly may migrate as far as one or two miles and then lay its eggs on wheat. Wheat seeded on islands in the Missouri river is often severely injured. The pest in such a case migrates from infested fields on shore a mile or more away. Since the pest moves from farm to farm it is important that all wheat growers in a given neighborhood cooperate. One neglectful wheat grower may furnish enough flies from unturned stubble or volunteer and early seeded wheat to reinfest neighboring fields. This often occurs and usually the growers conclude that the remedies are not effective. However, if all will cooperate in plowing under stubble, keeping down volunteer wheat and seeding on the fly-free date, the pest can be effectively controlled.

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UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

COOPERATIVE EXTENSION WORK IN
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University of Missouri College of Agriculture Agricultural Extension
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CIRCULAR 81 COLUMBIA, MISSOURI JUNE, 1920

Raising Calves

For Baby Beef or Breeding Purposes

W. F. Etz, L. B. Mann

The practice of fattening young light-weight cattle as baby beeves has gained much favor with the corn-belt farmer because of the cheaper gains produced and the increasing demand for this type of steer. From the consumer's standpoint, the small, thick cuts of meat are becoming the most popular. Baby beef represents a special phase of beef-cattle production. The term "baby

Well-bred calves of the four beef breeds—Shorthorn, Aberdeen-Angus, Galloway, and Hereford—showing good width across the hips and backs beef" refers to choice and prime fat cattle between the ages of 12 and 24 months, weighing from 800 to 1,200 pounds; the average age being about 18 months and the weight averaging from 900 to 1,000 pounds.

REQUIREMENTS FOR BABY BEEF PRODUCTION

The fundamental requirements of successful beef production include good individuals, well bred and well cared for. The folfollowing suggestions are offered on the assumption that a conscientious effort will be made to meet the requirements above mentioned.

In setting out to produce a real choice baby beef, the first problem is in the selection of the calf. Only calves having good beef type, that is, straight top and bottom lines, deep and broad body, short legs, and showing good quality, should be selected. To meet these requirements the animal must be well bred, because dairy-bred calves will not usually reach the desired maturity and finish at an early age. Therefore, it is best to select a calf showing a preponderance of blood of one of the beef breeds. The beef breeds are: Shorthorn, Hereford, Aberdeen-Angus, and Galloway, and since these breeds have been developed for the production of beef it can be seen that it is most economical to obtain a calf of beef breeding and conformation.

FEEDING CALF FROM BIRTH TO WEANING TIME

Nothing so stimulates growth and early maturity as milk fresh from the dam but unless cows are exceptional milkers calves should be fed a small ration of grain as soon as they will eat it. In all cases calves should be fed grain for at least one month previous to weaning. Start in with a ground feed consisting of corn and oats and a little oil meal. A good ration is made up of corn three parts, oats three parts, and oil meal one part.

WEANING

Weaning time is the critical time with baby-beef calves and every effort should be made to keep them from losing their calf fat. The grain ration should be increased to the extent that the loss of their milk after weaning will cause very little change in their growth and fattening.

Calves should be weaned gradually. If they are running with the cows at all times, the weaning may be started by keeping the calves up and allowing them to nurse only twice each day for five or six days, after which they should be allowed to nurse only once a day for an equal period. Then one day's nursing may be omitted, and later on two days skipped. This is only one method by which calves may be weaned, and it will be necessary to adopt a a system best suited to the conditions arising so that the calf may receive the best possible care. It will generally take about ten to fifteen days for the entire weaning.

FEEDING FROM WEANING TO MARKET

Start in by feeding the calf about three to four pounds of grain daily up to the first week. Good clover or alfalfa hay or soybean hay, or a mixture of these, should be given the calves in a rack or manger where they will not waste it. Feed only such quantities as they will clean up each day. Silage will not satisfactorily replace these feeds, but if available should be fed at least once a day (in the morning if hay is fed at night) in such amounts as calves will clean up readily. Corn fodder may be substituted for silage but is not so good. Calves do not use corn stover in large quantities economically or satisfactorily.

Since corn is the most satisfactory feed to supplement the above named roughages and give a well-balanced ration, it should be used whenever possible. A ration of corn and linseed oil meal with clover or alfalfa hay and silage makes a very good ration. Corn may also be used with these roughages in such combinations as (1) corn two parts, oats one part; (2) corn three parts, bran one part, oats one part; (3) corn one part, bran or oats one part, one pint of linseed oil meal per head daily.

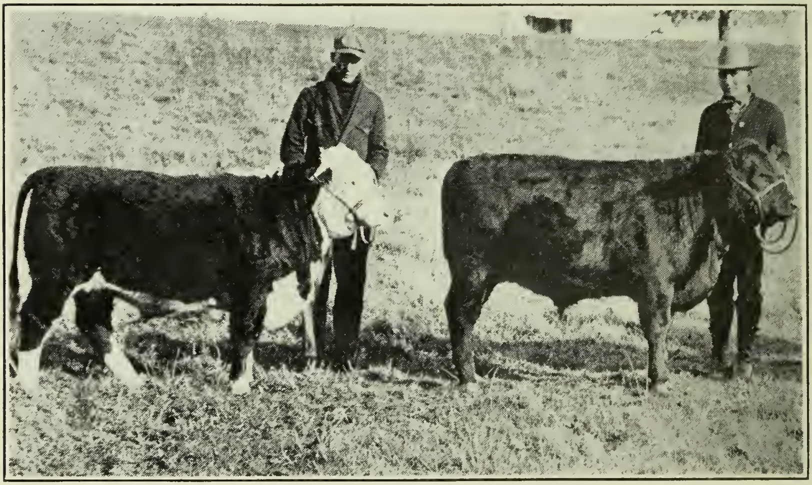
The amounts of the above described mixtures, except where specified, should be governed by the condition of the calves. Ordinarily, a purebred calf of modern type and bloodlines will justify a very liberal feeding. Breeders who expect maximum development will practically full feed calves thruout the winter months If the greatest growth and bloom is desired, a nurse cow for each calf will be required.

Calf owners should be governed somewhat in their feeding operations by the individual calf, and should remember that some calves do better on some feeds than others, hence it will be well to make gradual changes in feeds occasionally, when calves do not seem to do well. Do not make the mistake of changing too often

Calves are best started on any one of the foregoing grain rations rather slowly, feeding not over one-fourth full feed. Oats and bran with a little corn is a safe combination to start with, changing to one of the grain rations later. Corn should be fed shelled or ground. Ear corn is not an efficient or satisfactory feed for calves. Oats are best crushed, but they may be fed whole. Mix feeds before placing before animals. Grain may be spread over the silage and all fed together.

PLACE OF FEEDING, SHELTER, BEDDING

Accurate information as to the amount of feed fed can be had only by feeding calves separately. Calves will gain more rapidly and just as economically when fed alone as when fed with other cattle. Calves should never be fed with older cattle. Clean trough or feed box regularly. Do not permit refused feed to accumulate. Galvanized feed pans are easiest kept clean and sweet.



Calves of the Hereford and Galloway breeds. Note the long, straight backs, body depth and short legs

Successful cattlemen recognize that beef cattle must be sheltered from storms and furnished a dry, clean bed during the winter months. Close confinement is not necessary or advisable. On the other hand, such treatment may be to the detriment of the animals, an open shed being considered an excellent shelter.

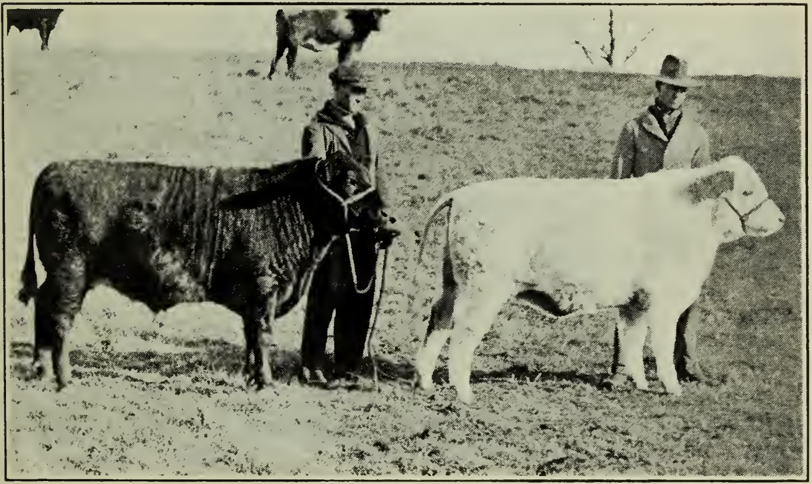
MANAGEMENT ON PASTURE

With good pastures, the hay and silage ration may largely be withheld and the grain ration slightly reduced, altho calves should be given all the grain they will eat while on pasture.

It is not best to carry calves thru the entire feeding period on grass, better results being obtained with finishing the last month in the dry lot.

MANAGEMENT

Aside from the actual feeding, there are a number of important problems to consider in raising baby beeves. If calves have not already been dehorned and castrated, this should be done. For particulars, see Farmers' Bulletin 811 on "Castrating and Dehorning Cattle."



Calves of the Aberdeen-Angus and Shorthorn breeds. Note the straight top-line, deep body, and short legs

Blackleg is a very common and fatal disease with young cattle and all calves should be vaccinated against it. The first indications of disease are dullness, loss of appetite, lameness and swelling in the shoulders or hind quarters. The swellings are hot and puffy, due to the presence of gas under the skin and in the muscles. Death usually occurs within twelve to twenty-four hours after lameness is observed. The carcasses of calves dying from blackleg should be burned. Information and vaccine may be secured free by writing the Veterinary Department of the College of Agriculture, Columbia, Mo.

POINTS TO KEEP IN MIND IN PRODUCING BABY BEEVES

1. Select a choice feeder calf of one of the beef breeds showing desirable beef type.
2. Don't let calf lose "calf fat."
3. Get on feed gradually.
4. Feed at regular hours.
5. Keep troughs and water tanks clean.
6. Watch calf closely and note any irregularity in appetite.
7. Be gentle in handling calf.
8. Get calf in choice to prime condition before selling, in order to get the best returns.

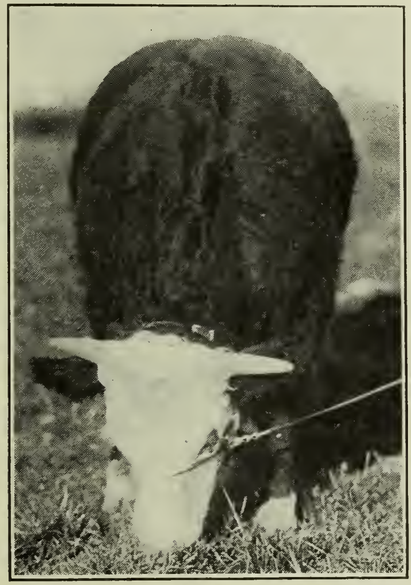
RAISING CALVES FOR BREEDING

First year.—For the first nine or twelve months, the breeding heifer may be handled the same as the baby beef, with the exception of feeding a limited grain ration. Aim to keep the calf growing. Give plenty of clover, alfalfa or other legume hay.

Second year.—Continue to feed heifer a good growing ration, consisting of corn and oats, or corn, oats and bran with two to three handfuls of linseed oil meal daily. Where silage is available, feed what the heifer will clean up together with a liberal ration of clover or alfalfa hay. When on pasture, heifers need little additional feed, a small quantity of grain daily, being sufficient.

Breeding heifer.—The heifer should be bred at 18 to 24 months of age, to a purebred bull of like breed. The bull should be a good individual, showing the same desirable form as considered essential in a good calf. To calve in April the heifer should be bred in June or July. Heifers should not calve before they are twenty-seven to thirty months old, and most heifers will do better if they are older than this at calving time.

Try to keep the heifer on pasture for as much of the year as possible. If pastures become short, feed a small amount of grain. From ½ to 1½ pounds of one of the above mixtures is generally sufficient. If grass is very sparse, some feed such as silage or hay may be added. During fall and winter, corn fields and meadows furnish good grazing. Such feeds as straw and corn stover can be fed when small amounts of a concentrate, such as cottonseed meal or linseed oil meal are fed. Where silage is available, it is undoubtedly one of the very best feeds to use in a winter ration for the heifer. It is neither necessary nor advisable to feed all she will eat but rather limit the amount to a medium ration of silage and supplement it with clover hay and other roughage, such as straw or corn stover.



Hereford calf showing the breadth and smoothness so desirable in the beef animal

Corn silage may also be supplemented by oat straw and a small amount of oil meal. If silage is not available a ration of shock corn, oat straw and a limited amount of clover or alfalfa hay is very satisfactory. In fact, a great many rations might be presented for carrying the heifer thru the winter, but the feeds on hand and the condition of the heifer will largely govern the ration used.

Third year.—Care of the cow and calf. If the cow is in a vigorous, healthy condition at time of calving she will probably need little if any assistance. While it is true that most calves born need no assistance whatever, yet it is true also that many which die would have lived had they had help at the proper time. Therefore, it is always best to be at hand to render aid should it be needed.

The calf should make rapid continuous growth from the time of birth. Give it all the milk from its dam unless too much milk is produced. In straight beef production only a small quantity of feed in addition to milk is needed for the first few weeks, but the calves should be taught to eat supplemental feeds within a few weeks after birth. The quantity of hay and grain consumed at first will necessarily be limited, but should be increased gradually until the calf can do without milk when from six to eight months old. Either of the following grain mixtures is very satisfactory: Ground corn three parts, oats three parts, oil meal one part; or a mixture of equal parts of ground corn, crushed oats and wheat bran. The calf should be given hay as soon as it is old enough to eat it. Clover or alfalfa hay is best.

For best development the calf needs plenty of fresh air and sunshine. Plenty of fresh, clean water should be available at all times; and salt should be kept within easy reach.

It is impossible to give too much attention to keeping the feed buckets, troughs, and lots clean. No calf can thrive under filthy conditions. Keep the feed buckets and troughs as clean as the milk pails, and keep the calf and its quarters clean.

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CIRCULAR 82 COLUMBIA, MISSOURI JUNE, 1920

How to Pad a Dress Form

Mary E. Robinson

Time, energy and money are saved by the woman who uses in her dressmaking a dress form padded to her own measurements. She saves time because she can hang her own skirts and fit her own clothes more quickly on a dress form, and because she does not have to undress and dress again each time she tries on a garment; she saves energy because she does not have to stand for long fittings and because the making of garments is more easily done with a dress form; she saves money because she can make more of her own clothes and does not have to hire them made or buy them ready-made.

It is difficult for the average woman to find on the market a dress form which can be used without some alteration because, like commercial patterns, dress forms are made according to average measurements, and few women are average in every particular. Their waists may be a trifle larger or smaller in comparison with their busts or hips; their shoulders may be broader or more sloping; their busts higher or lower or more or less full, their hips large or small and their waist long or short. None of these individual variations is accounted for in the ordinary commercial patterns or in the usual dress forms, and there are many dress forms on the market that are not the correct shape. The commercial dress form, therefore, needs to be padded so that it will fit exactly the woman who is going to use it.

The padded dress form is quite inexpensive when one considers its usefulness. It is substantial, and is well worth the few dollars it costs.

To make a padded dress form the following are needed:

(a) A tightly fitted lining made from paper cambric or very firm unbleached muslin.

(b) A commercial form one size smaller than the person for whom the form is to be made.

(c) Three or four rolls of cotton batting.

MAKING THE LINING FOR COVERING

Select a fitted waist pattern which is long enough to come well down over the largest part of the hips and with enough seams so that it can be fitted tightly. Usually a pattern having three pieces in the front, four in the back and a fitted collar, is chosen. Paper cambric or a good grade of muslin are probably the most satisfactory materials to use for the covering of the form. Baste the seams in the front and back of the waist on the right side, leaving the shoulder and underarm seams to be pinned when the lining is fitted. Put the lining on the person for whom the form is being made with seams on the outside and fasten the front and back into place with occasional pins down the center of each piece. If this is done it is easier to pin the seams closely so that they will conform to the lines of the body and correspond with each other. Pin the shoulder seams directly on top of the shoulder with seam running straight from heavy cartilage in neck to bone on shoulder, and with the underarm seam directly underneath the arm extending from the hollow of the arm down over the hip. If front and back do not fit, cut basting threads and pin seams. Be careful to fit the lining well around the armseye so that in fitting a waist on the form the armhole can be trimmed and the sleeve set in without trying on the waist. Often it is necessary to ake darts at the armhole to make the fitting quite perfect. When e seams of the lining have been pinned very tightly, mark the waist ne and remove from the model by opening the seam down the center ack.

Trim all seams to one-half inch and trace seam line with tracng wheel, or mark with tailor's tack. Remove pins from the lining, one seam at a time, turn the seam and baste securely on the opposite side, exactly on tracing. If a person were exactly alike on both sides it would not be necessary to baste the seams and fit on the right side and then open the seams and baste on the wrong side, but since very few women are alike on both sides this is necessary. When all basting has been done, try on lining to see that it fits, stitch all seams and try on again to see that stitching is done correctly. Pin a well-fitted collar in place at the neck. The armhole should be marked with a pencil for any necessary trimming. Remove the lining and stitch the collar into place. Bind the edge at the armhole with a bias binding to prevent stretching of armseye.

A Foundation form on which the padded form is made may be purchased from a dry goods store or from a dealer in such materials. Care must be taken in the selection of this foundation form to get one small enough. The hip and bust measurements must be considered as well as the thickness of the form in comparison with that of the individual. Misses' dress forms are usually a little better proportioned than ladies'. The misses' sizes are bought by ages which correspond to the following bust measures: 18 years, 38 bust; 16 years, 36 bust; 14 years, 34 bust; 12 years, 32 bust.

Dress forms should be bought one size smaller than one's bust measure. For instance, if one's bust measure is 38, buy a 36-inch size. A foundation form for a child twelve years old is a good size to buy if a finished dress form is desired with a bust measure of 34 inches. Very good papier-mache forms may be purchased from some companies without the stockinet coverings that are cheaper and equally satisfactory. Commercial dress forms cost $2 or more.

PADDING THE DRESS FORM

Three or four rolls of cotton batting are used to fill out the form to the proper fullness. The lining is first put on the form to determine where the form needs the most padding. The amount of padding necessary varies with the individual figure. The cotton is cut into pieces which may be handled conveniently and placed on the form where it is most needed. The padding should be done so that the form will be very firm when finished. Usually it is most convenient to pad the neck, shoulders and bust first. Cut a piece of cotton which will fit about the neck and pin it into place at the back. With most forms, long pieces of cotton extending from shoulders to hips may be used in both front and back. These long sheets when trimmed a bit at the neck, then pinned at the shoulders and hips, aid in holding any other necessary padding in place. When this padding has been done, slip the fitted lining on the form to see just how much, if any, additional padding is needed at the shoulder, neck or bust. Do this padding first and pin the lining together at the neck in the back. Then lift the lining and do any additional padding which is needed at the waist and hips. Before sewing up the lining at the back, pin it carefully and compare measurements of form at neck, bust, waist and hips with those of person for whom form is being made, to see that the padding has been done correctly. The padding must be done so that the form will be firm and smooth and no lumps or hollows should be visible. The form may be tested, too, by trying on a good fitting waist and skirt.

The opening left by the armhole may be filled in with a piece of the lining so that the stuffing will not fall out nor the padding interfere with the use of the form in fitting. Many find forms easier to use if this armhole is padded out slightly so that the form will have a bulge about like that of the arm. This is more easily done if a square piece of lining is placed at the sleeve opening with a corner at the top and the opposite corner at the bottom. The piece of cloth should be slipped underneath the bound edge of the armhole; pinned in place, so that the piece covers the opening smoothly, but does not draw; and hemmed.

Finish the bottom of the form by pulling down the lining snugly, turning and tacking to the board at the bottom of the form.

STANDARDS

Various kinds of standards may be used for the home-made or padded form. Whatever kind is used, care should be taken to raise the form so that it will be the exact height of the person for whom the form is made. A very good standard can be made by placing the large end of a broom handle in a block to make it stand firmly on the floor. A hole is then made in the center of the hip board thru which the small end will just fit. A satisfactory standard may also be made from a block of wood slightly smaller than the hip board, and 4 to 6 boards about 3 x ⅜ in., and long enough to raise the standard the desired height from the floor. Nail the boards to the hip board on the form and to the block of wood which serves as the floor rest. Commercial standards may be purchased for about $2.50. These are found for sale by companies who sell dress forms.

A satisfactory dress form of some kind is within the reach of every woman if she will but take the time and pains to adapt it to her own measurements.

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COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS

University of Missouri College of Agriculture and the United States
Department of Agriculture Cooperating
P. H. Ross, Acting Director Agricultural Extension Service
Distributed in furtherance of the Acts of Congress of May 8, and June 30, 1914

CIRCULAR 83 COLUMBIA, MISSOURI JULY, 1920

Economical Selection of Textiles and Clothing

Essie M. Heyle

Any material to wear well must have the following qualities:

Lengthwise or warp, and crosswise or woof threads, of about the same weight, and both threads strong enough for the purpose for which the material is to be used.

Firm weave.

Nothing in the material that can be easily picked off or pulled out.

To find out if warp and woof threads are equally strong, ravel goods a bit and compare the weights of the threads, also the ease with which they can be broken. Toweling, silk shirting, wool poplins, crepe-de-chine, outing flannel and cambric may have warp and woof threads of different strengths. If there is any difference in the weight of the warp and woof threads, the warp should be the stronger. Dimities woven of fine threads with an occasional heavy thread or cord do not wear well. Materials woven of round threads wear better as a rule than those woven of threads not so definitely rounded. Look for round threads in buying linens, muslins, silk hosiery, etc.

If goods is firmly woven, the threads will not move or slip when the material is drawn in both directions between the finger and thumb, and will not stretch much when held between the first fingers and thumbs and the wrong side of the cloth is rubbed by the first fingers with an upward pressure.

Swiss curtain or dress goods often has dots pulled thru the cloth once or pasted on, that come out or off in washing. Test by seeing if the dots can easily be pulled out or picked off. Heavy, rough, loosely woven wool material sometimes has wool fuzz worked in to give it a heavier appearance and this soon wears off, presenting a threadbare appearance. Test by seeing if this fuzz can be picked off. Satin weaves or novelty materials that have the thread carried a distance will not stand hard wear. Loose, long threads in materials to be laundered are apt to be caught and pulled by the iron.

MATERIALS MAY BE FOUND ADULTERATED

Cotton and occasionally linen may be sized heavily.

Cotton may be mixed with linen or sold for linen.

Silks may be weighted.

Artificial silk may be sold instead of genuine silk.

Cotton may be mixed with wool.

Shoddy may be used instead of part or all new wool.

Cotton and linen may be sized, that is treated with starch, glue or clay to make the material seem firmer, finer or better than it really is. Sizing can be detected by holding a thin material to the light or by a harsh chalky feel when material is rubbed with the finger and thumb tips or by scratching with the nail or rubbing across the knuckles and observing whether such places seem less firm and whether white powder comes from the material.

Linen threads in a material are more irregular and glossy than cotton threads. Linen materials feel cooler and smoother than cotton materials. "The test of moistening the finger and putting it under the cloth is not always a sure one, as the moisture will not come thru a heavy linen or one with much starch in it and will come thru a tightly twisted cotton." The best way to tell cotton from linen is to untwist a thread, so the fibers lie straight, and break. If the thread is cotton the broken end will be fuzzy and tufted looking but if linen the fibers will be glossy, uneven and pointed.

Weighted silks are dipped in a bath of tin, iron or other metallic salt to replace some of the weight lost when the gum is removed from the silk. Such silks crack on the folds, fray at the bottom of the skirt and fall to pieces soon whether the garment is worn or hangs in the closet. To test for weighting, ravel a sample of the silk, in both directions and apply a lighted match first to one set of threads then to the other. If the silk is not weighted the threads will burn, leaving little round globules at the ends. If the silk is weighted the flame will go out leaving the goods somewhat charred, but almost intact. The price is no sure indication as to whether or not silk is weighted.

Artificial silk is usually made of a cellulose material, as wood pulp, treated chemically in such a way that a more beautiful lustre than that of real silk results. It is not as soft, strong or elastic as true silk.

Most artificial silk does not wear well. It is weakened by washing and may even go to pieces in boiling-hot water. Artificial silk may be detected by burning a sample. Silk burns slowly and gives off an odor like that of burning feathers while artificial silks burn rapidly with an odor of burning paper. Floss, stockings, sweaters, draperies, braids, etc., as well as dress goods are often made of all or part artificial silk. Cheap silk stockings are often made of artificial silk; their purchase is not good economy.

It is not undesirable to mix cotton with such woolen articles as underwear, petticoats, blankets, etc., that must be washed often because the cotton prevents them from excessive shrinking; but cotton is undesirable in woolen materials used for most outer garments, because such mixtures do not hold their press well and wrinkle more than garments made of all wool. With experience, one can tell all wool material by the "feel." Such material crushed in the hand is springy, elastic and rather spongy, resisting the pressure of the hand and following the fingers back after pressing. Wool threads are kinky and if untwisted, pulled straight out and broken, the resulting sensation is quite different from that of cotton. Cotton gives a sharper, quicker break while the wool threads stretch and pull apart more slowly without the sensation of a real break. It feels as if each little fiber of the woolen thread was with difficulty disentangling itself. Wool burns slowly, gives a decided odor of burning feathers and leaves an ash in the form of a rounded mass, while cotton burns quickly with an odor of burning paper and leaves a fine, white, powdery ash. This test is not satisfactory if cotton is mixed with wool in the yarn. In such a case, or to tell how much cotton there is in a sample, boil a small piece for fifteen minutes in a cup of water to which one tablespoonful of lye has been added, or 30 minutes in a pint of soft water to which five tablespoonfuls of washing powder has been added. Wash sample and the wool will disappear, leaving the cotton.

Shoddy, or remanufactured wool, is made from scraps of wool from tailoring shops and from old woolen garments. This waste is treated chemically to remove the cotton, the threads are separated into fibers, and spun into new yarn. Very beautiful materials are made from shoddy. They do not wear quite so well as those made from virgin wool. Since shoddy is pure wool it is practically impossible to detect it. Shoddy is sometimes worked into a coarsely woven material to give it a heavier, warmer appearance. This works out as the garment is worn and is found in the bottom of coats, seams, etc., leaving the material threadbare. Shoddy felted into the weave of a rough material can be detected by picking at the surface to see whether the nap pulls out easily.

OTHER POINTS IN CHOOSING MATERIALS

Unbleached muslin and linens wear better than bleached.

Mercerized materials wear better and hold their color longer than materials not mercerized. Not all goods having lustre is mercerized. It may be given only a special dressing or finish and not be dipped in an alkaline bath and dried under tension, as is necessary to make mercerized goods. True mercerized materials retain much of their gloss after laundering while the imitations do not.

Soft silks as foulards, crepe-de-chines, georgettes, etc., wear better than stiffer silks, as satins or taffetas. It pays to get a good quality of crepe-de-chine and georgette because they can be tinted or dyed successfully when one tires of their original color,

Yarn dyed materials hold their color better than printed materials. Before buying goods for a garment that will be washed it is a good plan to get a sample and wash half of it to see whether the colors run. If a material is for a garment that will be worn a great deal out of doors, test for sun fading by covering half of the sample and leaving out of doors in the sun light for two weeks. Cotton holds color better than linen. Lavender, greens, and browns are often less permanent than other colors.

Standard make materials and those with trade names are the most reliable. The buying of novelties and sale specials is seldom good economy, altho real bargains can often be obtained at between-season sales.

Laces and embroideries that have firm strong edges should be bought. Lace should have no weak connecting threads. Narrow linen torchon and cluny laces wear better than valenciennes laces on underwear. Embroidery should not have large holes and the pattern should not be too heavy for the weight of the goods upon which is is made. Cambric embroideries wear best. Plain white stickerei, which is a narrow scalloped braid, makes a very attractive and economical trimming. Narrow white linen tape is cheaper and more satisfactory for drawing up underwear and is in much better taste than colored ribbon.

BUYING CLOTHING

Before buying a season's clothing, decide just what garments are on hand that can be renovated and used again and what must be bought. The new garments should be selected so that they will serve the greatest number of uses, will wear well and will harmonize with the wardrobe already on hand.

Whether it is more economical to make one's own clothes, have them made by a dressmaker or tailor, or buy them ready-made depends upon how satisfactory the garments are in each case and upon what one has to pay for ready-to-wear garments and for dressmaker's bills. Homemade articles of underwear often cost as much as ready-made ones but are more economical because they wear better.

It is more economical to limit the number of colors worn so the hat, petticoat, gloves, etc., will look well with any of one's costumes.

It never pays to buy extreme styles or garments made in such a fashion that everyone knows exactly what year they were bought.

Many women find that they can dress better and at less cost if they buy very few garments, but select those they do buy carefully so that they are becoming, conservative in style, well fitting and of good workmanship and material. Even tho such garments cost more in the beginning, their purchase is usually not an extravagance because they require less making over, are not discarded until worn out and give satisfaction the whole time they are worn.

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CIRCULAR 84 COLUMBIA, MISSOURI JULY, 1920

Profits from Farm Poultry Flocks in Missouri for 1919

T. S. Townsley

Directly opposite opinions are often expressed by city consumers and country producers in regard to the profits from poultry. Many city housewives maintain that eggs are too high, while some farmers say there is no profit in poultry at current prices. Few definite figures are available to prove either contention. At least 90 per cent of the eggs in the United States are produced on general farms where poultry is a side line. A large majority of these eggs come from the cornbelt states.

Since Missouri is one of the principal egg-producing states the following figures from farm flocks located in twenty-five Missouri counties and representing every section of the state are presented for what they may be worth in throwing light upon the costs and profits from producing eggs on corn-belt farms.

The farms which submitted the figures included in this report are typical of the section represented, but the poultry flocks on these farms probably received better than average care, because the owners were following as nearly as possible directions furnished by the Poultry Department of the University of Missouri for handling farm fowls.

It is interesting to note that the average hen on the farms included in these reports laid 106 eggs, while the average for all hens in the state is less than 75 eggs a year. Since the cost of producing a dozen eggs is directly affected by the number of dozens laid in a year there is no ground for using the figures here sub-

TABLE 1.—SUMMARY OF REPORTS FROM MISSOURI DEMONSTRATION FARM FLOCKS FOR 1918-19

	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.
Number of flocks......	26	24	25	47	97	126	89	82	74	67	58	68
Total number of hens..	3,796	3,672	3,800	7,473	14,478	17,690	12,717	11,025	9,465	7,350	5,925	5,952
Total number of eggs..	7,971	13,219	18,240	64,268	209,957	270 058	175,100	111,003	90,586	68,146	47,208	40,041
Per cent production...	7.0	11.6	15.5	30.7	46.8	51.7	44.5	33.3	31.0	29.7	26.3	26.6
Per cent eggs for year.	1.9	3.4	4.5	8.1	13.7	14.6	13.0	9.4	9.0	8.7	7.4	6.3
AVERAGE FARM FLOCK RECORD												
Number of hens......	146	153	152	159	149	140	143	134	128	110	102	88
Income from eggs....	$ 14.28	$ 24.48	$ 29.69	$ 35.85	$ 60.70	$ 67.19	$ 63.32	$ 39.59	$ 36.28	$ 30.16	$ 27.02	$ 25.28
Income from fowls....	$ 6.70	$ 5.81	$ 11.53	$ 2.58	$ 6.77	$ 6.16	$ 12.75	$ 19.00	$ 28.22	$ 29.51	$ 24.78	$ 20.04
Total income..........	$ 20.98	$ 30.29	$ 41.22	$ 38.43	$ 67.47	$ 73.35	$ 76.07	$ 58.59	$ 64.51	$ 59.67	$ 51.80	$ 45.32
Feed cost per farm....	$ 16.18	$ 19.10	$ 20.13	$ 19.28	$ 19.90	$ 20.50	$ 25.58	$ 23.67	$ 24.76	$ 22.99	$ 25.78	$ 19.87
Net income over feed.	$ 4.80	$ 11.19	$ 21.09	$ 19.15	$ 47.57	$ 52.85	$ 50.49	$ 34.92	$ 39.75	$ 36.68	$ 26.02	$ 25.45
Eggs per hen.........	1.9	3.4	4.5	8.1	13.7	14.6	13.0	9.4	9.0	8.7	7.4	6.3
Feed cost per dozen eggs	63.4c	41.6c	33.1c	16.9c	11.1c	11.3c	8.7c	12.0c	12.5c	13.0c	15.2c	21.5c
Price of eggs per dozen.	56c	53c	43c	32c	34c	37c	39c	35c	35c	36c	40c	52c
Income per hen.......	14.4c	19.8c	27.1c	24.2c	45.3c	52.4c	53.2c	43.7c	50.0c	54.2c	50.8c	51.5c
Feed cost per hen.....	11.1c	12.5c	13.2c	12.1c	13.3c	14.6c	17.9c	17.6c	19.3c	20.1c	25.3c	22.6c
Income over feed per hen	3.3c	7.3c	13.9c	12.1c	32.0c	37.8c	35.3c	26.1c	30.7c	34.1c	35.5c	28.9c
THE BEST FARM FLOCK RECORD												
Number of hens......	530	526	525	521	519	511	503	500	497	490	330	278
Income from eggs.....	$ 99.15	$219.25	$204.00	$173.18	$427.06	$532.76	$387.90	$250.44	$235.10	$139.29	$105.85	$105.85
Income from fowls....	$ 1.20	.....	.....	$ 2.00	$ 82.40	$ 15.00	$ 61.75	$ 97.96	$137.51	$ 25.45	$169.50	$ 86.62
Total income.........	$100.35	$219.25	$204.00	$175.18	$509.46	$547.76	$449.65	$348.40	$372.61	$235.14	$308.79	$192.47
Total feed cost.......	$ 42.25	$ 79.15	$ 79.62	$ 64.05	$ 89.25	$104.75	$133.10	$128.20	$144.00	$111.25	$110.00	$ 80.30
Income over feed cost..	$ 56.10	$140.10	$124.38	$111.13	$420.21	$443.01	$316.55	$220.20	$228.61	$123.89	$198.79	$112.17
Income per hen.......	19.0c	41.7c	38.8c	33.6c	98.1c	107.2c	89.4c	69.7c	75.0c	40.8c	93.6c	69.2c
Feed cost per hen.....	8.0c	15.0c	15.1c	12.3c	17.2c	20.5c	26.5c	25.6c	29.0c	22.7c	33.3c	28.8c
Income over feed per hen	11.0c	26.7c	23.7c	21.3c	80.9c	86.7c	62.9c	44.1c	46.0c	18.1c	60.3c	40.4c

mitted as a basis for asserting that all farm poultry keepers are making a profit. In fact these figures leave but little question that the farm flock owners in Missouri who are securing poor egg production are keeping hens at an actual loss. The figures do show, however, that the farm poultry keeper who handled his hens in such a way that they laid an average of 106 eggs made a reasonable labor income for 1919. At the same time the net profit on each dozen eggs after the cost of feed, labor, interest, mortality and depreciation are deducted, does not indicate that the farm egg-producer is a rank profiteer.

In compiling these reports all figures except for labor were furnished by the cooperators in the Missouri Demonstration Farm Flock Contest, and all reports submitted are included in these summaries. The labor charge is estimated, as no definite figures were available. One hour of labor was allowed daily for the average farm for egg production and one hundred and eighty hours of labor were allowed for raising the chicks on each farm. Labor was charged for at the rate of forty cents an hour.

TABLE 2.—THE BEST FARM FLOCK COMPARED WITH THE AVERAGE

Per Farm	Best Record	Average Record
Number of hens	477.00	134.00
Number of eggs	76,320.00	14,244.00
Percent production	43.80	29.10
Pounds of grain	26,800.00	9,109.00
Pounds of mash	9,050.00	2,906.00
Pounds of animal protein	4,300.00	735.00
Total pounds of feed	40,150.00	12,750.00
Per cent of animal protein	12.00	6.10
Ratio of grain to mash	2.0:1	2.5:1
Eggs sold	$2,483.67	$453.84
Birds sold	$ 679.39	$173.86
Total sales	$3,663.06	$627.70
Feed cost	$1,167.92	$257.74
Net income over feed	$2,495.14	$369.96
Increase in flock value	$ 95.00	$ 31.68
Interest and depreciation	$ 168.31	$ 35.25
Total labor income	$2,421.83	$366.39

TABLE 2.—THE BEST FARM FLOCK COMPARED WITH THE AVERAGE

Per Bird	Best Record	Average Record
Number of eggs	160.00	106.30
Pounds of feed	84.20	77.70
Pounds of feed per dozen eggs	6.30	10.80
Feed cost per dozen eggs	18.3c	21.7c
Average price per dozen eggs	46.9c	38.2c
Income from eggs	$6.25	$3.39
Income from fowls	$1.44	$1.29
Total income	$7.69	$4.68
Feed cost	$2.45	$1.92
Return over feed cost	$5.24	$2.76
Increase in flock value	$ .20	$ .24
Interest and depreciaton	$ .35	$ .29
Labor income	$5.09	$2.73

TABLE 3.—PROFITS ON EGGS FROM FARM FLOCKS

	Best Flock	Average Flock
Total dozen eggs per farm	6360	1187
Cost of feeding hens per farm	$813.49	$186.42
Interest and depreciation charges	168.31	35.25
Labor charge per farm	292.00	146 00
Mortality cost	31.00	13.00
Total expense	1,304.80	380 67
Total cost per dozen eggs	20.5c	32.1c
Average selling price per dozen	46.9c	38.2c
Net profit per dozen	26 4c	6.1c

TABLE 4.—PROFITS FROM RAISING CHICKS IN FARM FLOCKS

	Best Flock	Average Flock
Eggs set	1493	713
Chicks hatched	991	421
Chicks died	252	116
Cockerels and cull pullets sold	419	165
Pullets kept	320	133
Feed cost for growing stock	$354.43	$71.32
Value of eggs set	44.79	21.39
Labor cost of raising chicks	142.00	72.00
Total expense	541.22	164.71
Income from birds sold	679.39	173.86
Increase in value of stock	95.00	31.68
Net profits on birds raised	233.17	40 38
Profit per chick raised	31.5c	13.5c

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CIRCULAR 85 COLUMBIA, MISSOURI AUGUST, 1920

White Diarrhea in Chickens

A. J. Durant

In considering the infectious white diarrhea the poultry raiser should remember that diarrhea in chicks may result from other causes than the specific germ of white diarrhea. In the small chick diarrhea may be caused for instance, by chilling, arising from indiscreet handling of the nursery trays of the incubator. These trays may be at a temperature much below that of the egg trays. The subjection of the newly hatched chick to a lower temperature would chill it and in many cases cause diarrhea. The chicks may also be chilled by carelessness in transferring them from the incubator to the brooder in a cool room, and by failure to warm the container which the chicks are to occupy. The hands, and the cloths with which the chicks are covered, should be warm. Every precaution should be taken to maintain a proper temperature for the young chicks. Chicks raised with the hen should not be let out of mornings until the grass has become dry, to avoid the chilling which may result from becoming wet.

Another condition which may cause diarrhea is overheating the incubator or brooder; this may interfere with the natural absorption of the yolk and cause sickness after the chick is a week old.

Diarrhea may also be caused by musty or sour food, or by allowing the chicks to scratch in musty chaff.

The cases of diarrhea and death of young chicks from the foregoing causes are probably small as compared with the losses resulting from *infectious white diarrhea.*

Cause.—Infectious white diarrhea of chicks is caused by a microscopic organism known as the "*Bacterium pullorum*". This organism can be readily isolated from affected chicks and easily transmitted to healthy ones by feeding or inoculation experiments; as has been verified by the writer.

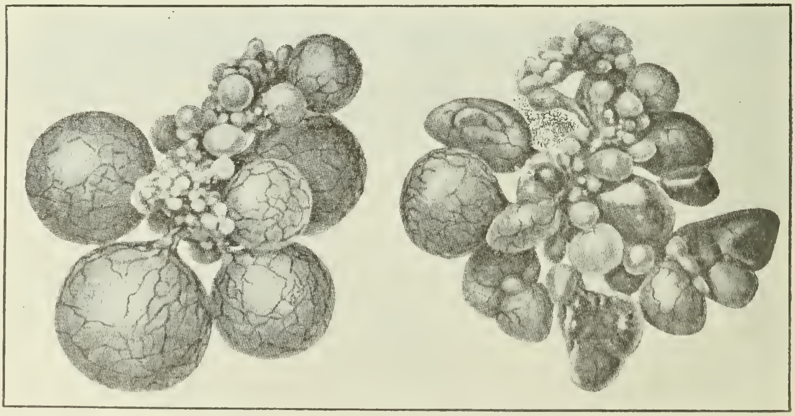
Grown chickens are practically immune to the disease, so far as any visible effects upon the general health is concerned; but it has been found that hens may harbor the infection in the ovaries and that the eggs of such hens may also become infected and result in the infection of the young chicks which are hatched from these eggs. About one-fourth of all the eggs laid by an infected hen will contain germs of this disease. It is thus seen that the hen is the responsible source of the infection. Infected hens usually exhibit an ovary containing several angular, hard, discolored ova; however, the organ may continue to function and from time to time an egg is released which harbors the germs of white diarrhea. (See accompanying illustration.)

Mode of infection.— Young chicks are infected by the germs of this disease in three ways; thru the infected egg from a hen that is a carrier, by coming in contact with those that have acquired the disease, and by being housed in contaminated brooders or pens that were recently occupied by infected chickens.

Symptoms.— In the most acute form of this disease chicks may die suddenly after having shown but slight symptoms for a short time. Usually there is shown a disposition to huddle together and to remain under the hover or under the hen more than young chickens should. Very soon they appear listless, stupid, and sleepy. The wings droop or project slightly from the body, and diarrhea may soon appear. The droppings voided may be white or creamy, and are sometimes mixed with a brownish material. This sticky excrement often collects to such an extent that the vent is stopped, and, unless soon relieved, will cause the death of the chick in a short time.

The diseased chicks chirp or "peep" almost constantly. They become rapidly weaker, breathe with effort, and death soon follows.

The disease may take a more chronic course, and the chicks live somewhat longer. They gradually become weaker and waste away until their legs are scarcely able to support their bodies. They stand with legs apart or rest against a wall or other object for support.



NORMAL OVARY INFECTED OVARY

Note the angular, misshapen eggs in the infected ovary.
(Illustrations from Bulletin 77, Storrs Agricultural Exp. Station)

Toward the last the chick becomes completely exhausted and sits constantly or lies on the side with outstretched wings until it dies.

The term "white diarrhea" suggests that diarrhea is a constan symptom of this disease. Some chicks, however, die from this infection without showing symptoms of diarrhea.

The mortality from this disease is very high, ranging from 50 t 100 per cent in an infected flock. Experience has shown it to be unprofitable to attempt to raise chicks from infected stock. Infecte hens should be disposed of.

Appearance of affected organs.—To avoid mistaking decomposition changes for disease, in the examination of the internal organs, the post-mortem examination should be made as soon after death as possible. It is preferable to kill a sick chicken and examine the organs at once.

The **liver** shows the most constant, visible changes, tho it is held by some observers that the unabsorbed yolk is the most characteristic sign of this disease. In healthy chicks the yolk at this age should be almost completely absorbed. The liver is pale with the exception of areas of blood congestion, reddish in color. Microscopic examination shows a marked congestion of nearly all organs

Diagnosis.—The symptoms and the appearance of the organs on post-mortem examination, as described above, should lead the poultryman to suspect white diarrhea. Where large numbers of day-old chicks die presence of the disease may be strongly suspected; and measures should at once be instituted to prevent further losses. The Veterinary Department of the Agricultural Experiment Station will give aid in making laboratory tests. Those who desire this service should send a few of the sick chicks to the Veterinary Laboratory, University of Missouri, as early as possible after the outbreak has occured. Send the chicks by special delivery, parcel post to ensure the most prompt delivery.

If the infection is found in the young chicks its source, in some infected hen may be found by means of a blood test of the hens in the flock. The blood sample from a suspected hen is drawn from a vein of the wing. This vein is located on the under side of the wing and is exposed by pulling out the feathers for a space of about an inch along the barest part of the under side of the wing. The hen should be placed on a table and on her back with the wing projecting over the edge of the table to facilitate collecting the blood as it flows from the vein. The vein is cut across with a sharp knife and the blood is allowed to flow into a small vial. Homeopathic vials of one dram capacity are convenient containers for collecting and transporting the blood samples. They should be clean and sterilized by boiling; then dried thoroly to remove all traces of moisture before collecting the blood. The vials should be filled one-half to three-fourths full, then stoppered tightly and set in a cool place for a few hours until the blood is very firmly clotted. They may then be sent by parcel post to the Veterinary Laboratory of the Agricultural Experiment Station for examination. Each vial should be labeled with the leg number or other identification mark of the hen supplying the blood sample.

The breeding from the vein of the wing may be stopped by placing a small wad of absorbent cotton on the wound and pressing the wing firmly against the body in such a way that the cotton will stay in place. After a few minutes the bird is gently placed back in the pen.

All hens that show a positive reaction to the test (which indicates that the ovaries are infected) should be destroved. The dressed bird can be sold, or cooked for the home table. The cooked meat is not unhealthful for food.

Prevention and control.—In the foregoing discussion, some of the measures of prevention and control have been indicated, such as the detection and removal of all infected hens from the breeding flock. It is also evident that eggs used for hatching should be secured from flocks known to be healthy, and the eggs of which have in the past hatched healthy chicks. Otherwise it is better to produce eggs needed for hatching on the home farm from tested hens. Indiscriminate buying of eggs for hatching, and the purchase of day-old chicks from infected farms has introduced the disease to numbers of healthy flocks. The eggs selected for hatching should be kept, until ready for incubation, in a dry moderately cool place; and so spread out that the air can circulate over them to carry away the moisture that would otherwise collect on the surface of the eggs. If hens are used for hatching they should be free from the white diarrhea infection and be healthy in other ways. The skin and plumage should be treated with sodium fluoride to prevent infestation with lice.

If the incubator is used, it should be thoroly cleaned, preferably with boiling water; and in case diseased chicks have been in it, it should be disinfected with a 3 per cent compound cresol solution (Liquor Cresolis Compositus), that is in the proportion of one ounce of the compound cresol to each quart of water. Every crack, corner or crevice should be well disinfected. The brooder should also be thoroly disinfected.

Hens with their broods should be put on clean grounds and chicks which sicken should be immediately removed and destroyed. By frequent disinfection or moving to fresh ground, the disease may be limited to those that are hatched with the disease germs in them. To prevent the spread of the disease from chick to chick in the incubator it is recommended that a dark cloth be hung over the front of the incubator so as to darken the interior. The chicks under these conditions are not so likely to pick up the droppings of the infected chicks.

There is no known cure for this disease. However, by feeding buttermilk the increase of vigor in chicks not yet affected seems to prevent fatal infection in some of them, altho exposed, and may be helpful in a like manner to some of the infected chickens. Moreover it is thought that the buttermilk may change the bacterial flora of the intestinal tract and have some antagonistic effect toward the germs of white diarrhea. This nutritional method of treatment is useful in ordinary cases of diarrhea; but too much dependence should not be placed upon it in treatment of the infectious type of the disease, as the infection tends to localize in the ovaries of the young pullets and will give trouble later in the progeny.

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CO-OPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS

University of Missouri College of Agriculture and the United States
Department of Agriculture Cooperating
P. H. Ross, Acting Director Agricultural Extension Service
Distributed in furtherance of the Acts of Congress of May 8, and June 30, 1914

CIRCULAR 86 COLUMBIA, MISSOURI AUGUST, 1920

Paralysis of Hind Quarters in Swine

Dr. J. W. Connaway

Paralysis of the hind quarters in swine may result from one of several causes; and the treatment will vary to some extent according to the cause of the paralysis.

The causes are: (1) injuries; (2) impaction of the lower bowels; (3) kidney worms; (4) heavy suckling; (5) lumbago or rheumatism. Each of these causes and the preventive and curative measures are discussed in order.

Paralysis from injuries.—If the hog has been running in the same lot with horses, mules or cattle, it may have been kicked, pawed, horned or stepped upon, and sustained an injury of the spine, legs, or muscles of the back or hips. Make a thoro examination of these parts. Sometimes an injury is deep seated and can be detected only by firm pressure and other manipulations of the paralyzed parts which bring out evidence of pain, fractures of bones, or ruptures of tendons and muscular tissues; or the presence of deep-seated abscesses.

If the paralysis is due to an injury the best treatment is absolute rest. Put the patient under shelter in a comfortable stall where it can be bedded and kept quiet. Feed a light, laxative diet and keep the stall and bedding clean. After a time a stimulating liniment rubbed over the injured parts may hasten recovery. A mixture of equal parts of turpentine, ammonia and cottonseed oil makes a very good liniment. An abscess should be opened and receive proper antiseptic treatment.

Paralysis from impaction of the bowels.—Paralysis of the hind quarters may result from an impaction of the lower bowels with hard masses of dung, causing excessive pressure upon the nerves and blood vessels in the pelvis or hip region. If the paralyzed hog seems to be badly constipated, use rectal injections of warm water to soften and remove the hard lumps of dung. Add a couple of tablespoonfuls of Glaubers salts to slops and feed twice daily until the bowels are loose. Impaction is most frequently due to improper feeding, and to lack of tone of the bowels. A properly balanced ration with a proper supply of water, will prevent impaction of the bowels. In cold weather hogs frequently do not have a proper supply of water. If the water is icy cold, hogs do not drink a sufficient quantity, and are liable to become constipated. Some provisions should be made for warming the water to take off the chill. A warm slop once a day will be helpful in keeping the bowels of the brood sow in good condition.

The following tonic will also be found useful: equal parts of pulverized copperas, Glaubers salts, sal soda and common salt, and a double portion of powdered charcoal, which should be thoroly mixed and put in a self-feeder where all the hogs can have free access to it.

Paralysis from kidney worms.—The so-called "Kidney Worms" (*Stephanurus dentatus*) may cause paralysis of the hind quarters, when these worms are present in large numbers in the sublumbar or loin region. These worms, in the embryo stage, migrate into the fatty tissues around the kidneys, and sometimes into the kidneys and other organs, as the liver and pancreas. They produce inflammation and at times abscesses in the tissues where they lodge. Since they are found in largest numbers in the kidney fat and loin region, where the nerves are given off from the spinal cord to the hindquarters, the functions of the nerves of this region are more liable to be affected by these parasites and their toxic products. The blood supply of the paralyzed parts may also be affected by the invading parasites.

A brisk rubbing or massage of the loin muscles, with application of the liniment mentioned above, to stimulate the nerves and increase the blood circulation of the affected region will be helpful. Turpentine should also be given internally; this will destroy many embryo worms in the intestines. Since turpentine is very diffusible it is believed to be useful in destroying these parasites in the tissues around the kidneys. To a 200-pound hog, give a tablespoonful of turpentine in a half pint of oil (cottonseed or raw linseed). Milk may be substituted for oil. Shake well before drenching. Use a small-neck bottle and give the drench slowly, or smaller doses may be added to the slop. The following worm remedy is also useful: Santonin 6 grains, and calomel 4 grains, to each 100 pounds of live weight. Get the bowels empty before giving the medicine. The santonin and calomel should be mixed thoroly with a small feed of dry meal or shorts which may then be moistened and fed alone; or the meal and medicine may be stirred into a feed of slop. Repeat the treatment in a few days. As a preventive, use freshly slacked lime liberally over the hog yards to destroy embryo worms on the grounds over which the hogs feed. Give the hog yards a thoro liming and cleaning several times a year. This will destroy the eggs and embryos of many other parisitic worms that infest hogs and lower the vitality.

Paralysis from heavy suckling.—Brood sows that do not have a proper ration, or that are not able to utilize it effectively sometimes go down in the hind quarters from suckling a big litter of rapidly growing pigs. The rapid growth of the pigs requires considerable protein for muscle building and considerable bone-making material. All this must be supplied thru the milk of the mother, and if the sow is not fed the right ration her own muscles and bone tissue are depleted to supply proper elements for the growth of the pigs; and the weakened condition mentioned, results. This can usually be prevented by giving a food rich in protein and bone-making materials along with the corn ration. Protein supplements such as tankage and linseed meal should be provided. Protein may also be supplied by leguminous crops—clover, alfalfa, cowpeas and soybeans. Hogs relish these legumes as field forage or as cured hay. Brood sows that have access to a feeding rack kept full of "pea green" alfalfa hay, or the other legumes, will have no trouble in supplying their pigs with both muscle and bone-forming materials, and will not be in much danger of going down in the hind quarters during their lactation period from too heavy a drain on their tissues. A little crushed wheat or corn and bran, made into a slop with skimmilk is an excellent prescription to fill occasionally for sows that are running down from suckling large litters of pigs. Heat the milk to almost boiling point for a few minutes before adding the grain constituent; this will prevent any possibility of transmitting tuberculosis or contagious abortion to the brood sows thru cow's milk.

Paralysis from lumbago or rheumatism.—A board off the hog cot may permit a cold draft to blow on the back of the hog at night. This chilling of the loins may produce lumbago, and a temporary paralysis of the muscles of the hind quarters. Sleeping in wet bedding or manure piles, or around hay stacks is liable to cause rheumatic troubles in the hind quarters, and inability to walk. Comfortable sleeping quarters prevent these troubles (as well as pneumonia). It is a mistaken notion that the thick layer of fat with which swine are provided is sufficient protection against winter storms. On the contrary, swine often suffer severely from cold and wet if not properly sheltered and properly bedded. If affected with lumbago or rheumatism, clean out the bowels by means of a brisk purge (two to four tablespoonfuls of Glaubers or Epsom salts administered in a pint of warm water). Cut down the protein constituent of the ration. Feed thin warm slops to which baking soda is added in tablespoonful doses. Apply hot packs to the loins and paralyzed limbs; massage the muscles and apply a stimulating liniment with brisk rubbing. Bed warmly and cover the body of the patient with a thick horse-blanket if the weather is cold.

The herdsman and the veterinarian must study each case, and all the conditions to determine the probable cause. The same nursing and general care is applicable to all the cases.

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CIRCULAR 87 COLUMBIA, MISSOURI AUGUST, 1920

Stomach Worms In Sheep

J. W. Connaway

During August and September of each year the loss among lambs is considerable from infestation with stomach worms. Much of this loss could be prevented by prompt treatment of the flock.

Sheep raisers are advised to keep a close watch upon their flocks and to call the local veterinarian upon the first appearance of illness among the sheep. If veterinary aid is not available the information given herewith will be of some service, but the sheep owner must keep in mind the fact that "long distance" diagnosis, and "absent" treatment, by the Agricultural College veterinarians can never be an adequate substitute for the personal service of a

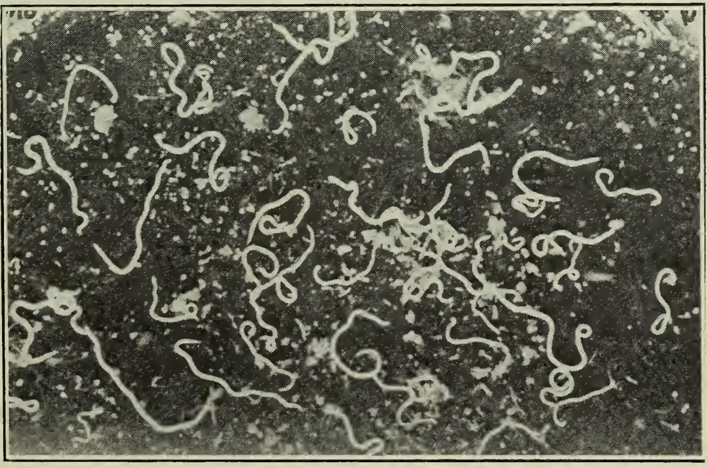

Fig. 1—Stomach worms (*Haemonchus contortus*) found in the fourth stomach of sheep. (Slightly enlarged.)

well-qualified graduate veterinarian who is near at hand, and who can make a prompt examination of the sick animals, and the conditions under which they are kept.

Infestation with stomach worms affects the lambs more seriously than the older sheep. None of the mature sheep may show any serious symptons, while a considerable number of the lambs may sicken and die.

The symptoms shown are loss of vigor, the lambs become dull, lag behind the flock, the head droops, and in some of the lambs a bagginess or swelling forms under the throats. Some may cough, and nearly all show evidence of diarrhea.

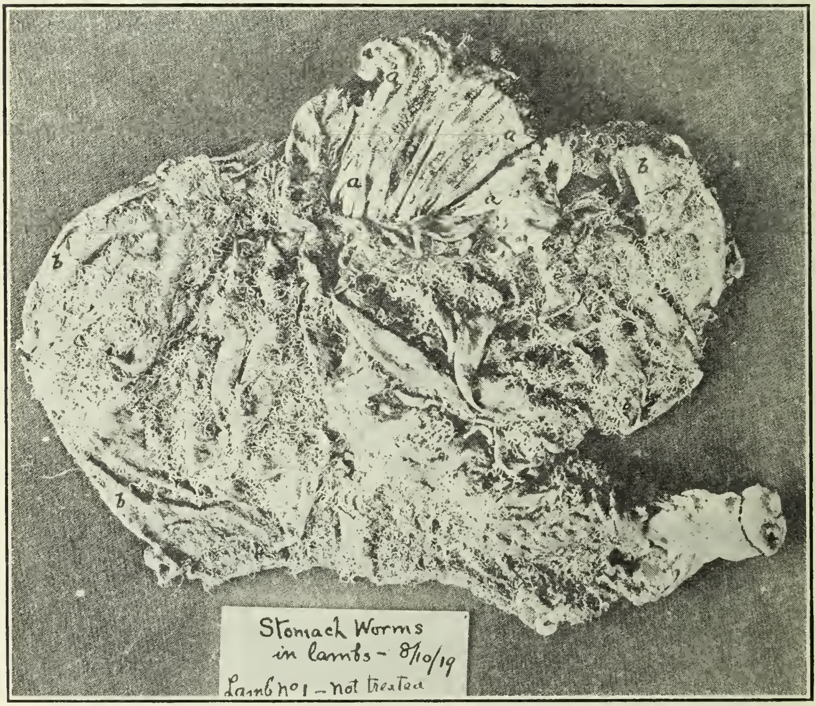

FIG. 2.—Stomach of lamb, not treated, showing large numbers of stomach worms.

If a lamb should die, a careful post-mortem examination should be made very soon after death, since decomposition changes occur rapidly in the organs of the sheep. Remove the pelt to facilitate the examination of the internal organs. Open the abdomen by cutting thru the walls along the attachment to the ribs, and continue the incision on each side backward to the flank, then turn the large flap of belly muscles back over the hind legs, or between them. The stomach, liver, spleen, large and small intestines are exposed to view. First remove and examine the several stomach compartments. Sheep, like cattle, have four stomachs: the first stomach, rumen or paunch; the second stomach, reticulum or "honeycomb," a small pouch opening into the "paunch" near the entrance of the gullet or swallow; the third stomach, omasum or "maniplies," a small rounded

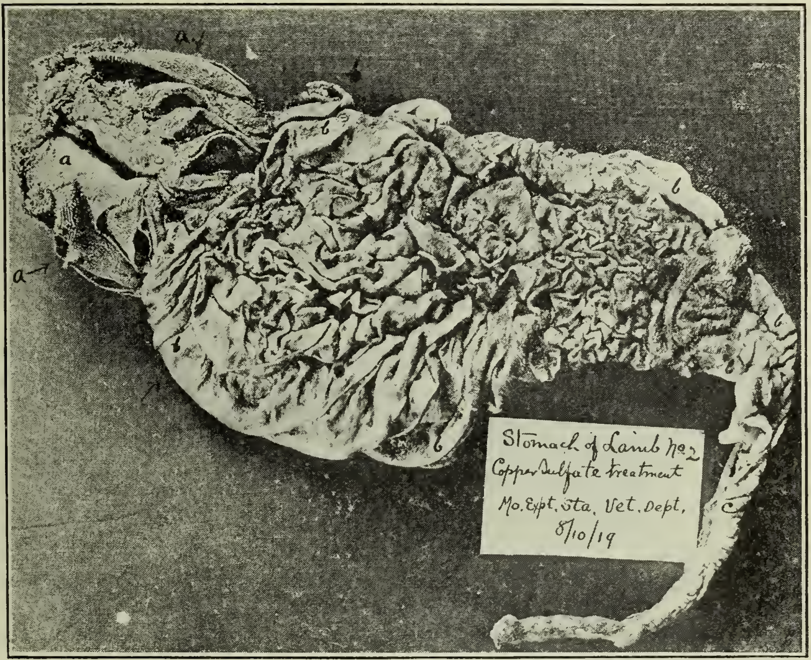

Fig. 3.—Stomach of lamb after receiving the copper sulphate treatment.

mass made up of a large number of thin partitions or "leaves," lying parallel with one another, and between which the semi-solid food passes on to the *fourth* stomach or abomasum," the portion which secretes the digestive gastric fluid.

The stomach worms are found only in this last compartment. Sheep raisers have frequently overlooked the stomach worms, even when they were present by the hundreds, by examining the paunch or first stomach, instead of the fourth or last stomach. This portion is an elongated pouch ten or twelve inches long, broader at the end connected with the maniplies, and tapering toward its junction with the small intestines. The mucous surface is soft, slimy and vascular, and has a number of longitudinal folds which increase its mucous area, and between which the stomach worms may be hidden in large numbers, mingled with the food contents. In badly infested sheep the worms may be so numerous as almost to hide the mucous surface and folds. (See illustration of stomach of untreated lamb.)

The stomach worms, known technically as *Haemonchus contortus,* or in the older literature as *Strongylus contortus,* are about three-fourths of an inch long; some slightly longer and some shorter. They are very slender, and the females have spiral markings giving them a twisted or contorted appearance. These parasites cause irritation and congestion of the stomach, and doubtless produce toxic substances which increase their harmful action.

Treatment—Gasoline, given as a drench in ¼ to ½-ounce doses, mixed with milk or linseed oil has been a popular treatment. This treatment is repeated daily, or on alternate days, until three doses have been given.

A treatment which is now believed to be more effective is the *Bluestone treatment* consisting of the administration, by stomach, of a dilute solution of copper sulphate (bluestone) in water. The method of preparing the solution is as follows: Select pure bluestone crystals, free from white powder. Pulverize the crystals in a mortar and dissolve two ounces of the powder in a pint of hot water, then dilute to proper strength by adding a gallon of cold water. Mix thoroly. There will be 144 ounces of the solution; which is usually sufficient to treat the average flock.

The dosage is as follows:

Lambs 3 months old	three-fourths (¾) ounce
Lambs 6 months old	one and one-half (1½) ounces
Lambs 12 months old	two and one-half (2½) ounces
Sheep (full grown)	three and one-half (3½) ounces

The sheep should be deprived of feed and water for several hours before giving the treatment in order that the fourth stomach may be free as possible from food. Nor should the sheep have water for several hours (12 to 18), after the treatment so as to avoid diluting the bluestone solution and washing it out of the fourth stomach.

Method of Drenching.—The writer prefers the stomach-tube to the drenching bottle, as there is less danger of strangling the sheep, and the flock can be treated more rapidly. The flock should be handled quietly, and each sheep held in such a manner as to prevent struggling, while the treatment is given. The operator may stand astride a small sheep, and hold it quiet by the pressure of his legs. Large sheep may be set upon their rumps, or backed into a corner to prevent them from twisting about. A suitable stomach-tube can be improvised by selecting a piece of fairly stiff rubber tubing three feet long, with five-eighths inch outside diameter and three-eighths inch opening. The red rubber gas tubing which has a fabric and black rubber lining answers the purpose admirably. This tubing can usually be obtained at the local hardware stores. A small tin funnel is inserted into one end of the tube, thru which to pour the bluestone solution; the other end of the tube is cut to a sloping point so that the tube will pass down the throat more easily than if left square-cut. In mature sheep the tube may be passed down the throat a distance of two feet. There is no difficulty in passing the tube; precaution, however, should be taken to use a mouth-gag or speculum to prevent the sheep from chewing the rubber. A suitable mouth-gag can be made by selecting a pine board two inches wide and six inches

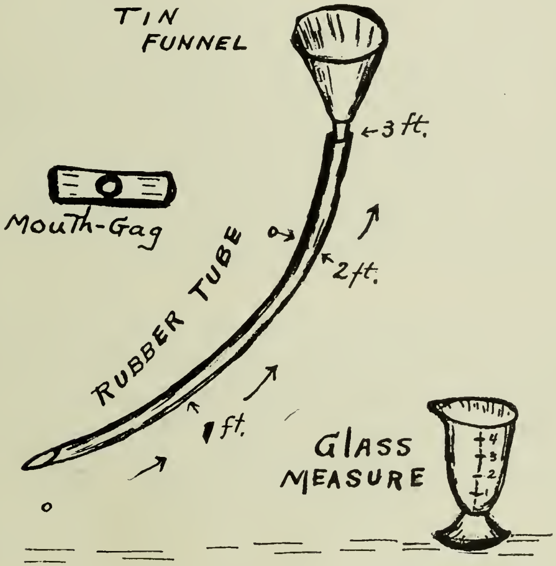

FIG. 4.—Apparatus used for drenching sheep.

long and boring a three-fourths inch hole in the middle. The edges of the board should be rounded off to prevent injury of the mouth.

It may be advisable to repeat the bluestone treatment on the third or fourth day if the worm infestation is severe, and again within a few weeks; but a single treatment is often sufficient.

Associated parasites.—In addition to infestation with stomach worms, the same lambs are sometimes infested with tapeworms and lungworms. Treatment in such cases is more difficult.

The diagonsis of tapeworm infestation can usually be made by finding short segments of the tape worms in the dung. The segments are white, and may be mistaken for mucus, but a closer examination will show their true nature. In the examination of a dead lamb the tapeworms are found in the small intestines, and sometimes occur in large numbers in a four to six-months-old lamb. The worms can be seen thru the walls of the gut by pressing the loops of the small intestines between the fingers and thumb. The diagnosis can be verified by cutting the intestine open lengthwise with scissors or a sharp-pointed knife.

The bluestone treatment, if repeated at intervals, is helpful in destroying the tapeworms, but it is advisable to give special treatment in addition; such as the administration of the oleo-resin of Male Shield Fern in half drachm to two drachm doses; or Kamala in doses of one to one and a half drachms; or Areca nut in one to three drachm doses. Mix the dose of one of these drugs with a half-pint, or pint of fresh milk, and give as a drench. It is usually best to follow the treatment in a few hours with a four ounce dose of Epsom or Glauber's salts.

Lung worms are sometimes found in small numbers in the bronchial tubes of fat, thrifty, butchered sheep without having caused any serious symptoms of illness. But when present in large numbers, in the lungs of lambs they cause bronchial irritation, coughing, collection of masses of mucus in the air passages, plugging of the smaller air tubes, and pneumonia or solidification of portions of the lungs. Their presence can be readily detected by opening the windpipe longitudinally by means of a large pair of scissors, or a sharp narrow bladed knife, and continuing along the course of the larger air tubes back to the tip of the main lobes. These larger air passages, within the lung, lie near the surface along the central face of the main lobes, and but little lung tissue need be cut in opening them. The lung worms are often found in masses protruding from the openings into the smaller bronchi, or in detached masses, mingled with mucus, lying along the inner surface of the larger air tubes which have been cut open.

Direct treatment, by intra-tracheal injections of medicines, cannot be carried out safely by the herdsman, and are of doubtful value, but the administration by way of the stomach, of teaspoonful doses of turpentine, well mixed with a pint of milk, will be of service in stimulating the bronchial mucosa; as turpentine diffuses into the blood and is carried to the lungs.

Success in the the treatment of sheep depends to a considerable extent in giving the remedies before the vitality of the lambs has been severely sapped by the parasites. Nutritious, easily digested food is also essential to keep up the strength and resistance of the lambs. Dry-lot feeding or change of pastures from time to time is helpful in preventing heavy worm-infestation. Infested pastures should be plowed and put in grain crops for a time, if the condition of the grounds permit.

Literature.—The following reference books should be on the self of each sheep-raiser and veterinarian, as they contain information on the care and feeding of the flock that will aid in the prevention of disease: Joseph Wing's "Sheep Farming in America"; Kleinheinz "Sheep Management"; Coffey's "Productive Sheep Husbandry"; Baker's "Diseases of Sheep".

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CIRCULAR 88 COLUMBIA, MISSOURI AUGUST, 1920

Pickling Fruits and Vegetables

Essie M. Heyle

CUCUMBER PICKLES

Gather cucumbers early in the morning, cutting each with a bit of stem and being careful not to bruise them or to rub off the little black briers. Brine at once. Put alternate layers of salt and of cucumbers 3 to 4 inches deep in a clean scalded stone jar or keg. About one pound of salt will be needed for each ten pounds of cucumbers, but the brine should be strong enough to float an egg. If the keg is of soft pine or one that cannot be made perfectly clean it should be painted with a thin layer of melted paraffin. To the first layer add enough water to start a brine, but do not add more water as the salt will draw sufficient water from the cucumbers to make a brine that will soon cover them. Spread a scalded cheese cloth six inches larger in diameter than the keg or jar over the top, then a board or plate almost as large as the jar or keg and on top of that a stone weight to keep the cucumbers under the brine. Do not use marble or limestone for the weight. If a scum forms on the surface remove it and throw away any soft cucumbers. If additional cucumbers are added to the jar, always remove scum before adding the layers of fresh cucumbers and salt. Cover again with cheese cloth and the plate or board both of which have been washed and scalded, and add weight. If the cucumbers are to be stored in the brine and pickled as needed, they must be sealed with melted paraffin as soon as fermentation has stopped. Remove all of the scum and if when the side of the jar or keg is struck, no bubbles rise to the top, fermentation has ceased. After the scum is all removed move jar or keg to a cool place where it may remain and pour hot melted paraffin to a depth of one-fourth inch over the top.

To make brined cucumbers into pickles remove them from the brine and test the saltiness of the cucumbers by tasting. If not pleasantly salty, add salt to the brine and let them stand until they are salty enough. If too salty soak cucumbers in cold water or preferably in weak vinegar. Cover cucumbers that are of the right saltiness with all of the following mixture, except the horseradish, which has been brought to the boiling point and is scalding hot.

½ gal. vinegar
2 cupfuls sugar
2 tablespoonfuls celery seed
2½ tablespoonfuls whole pepper
2 tablespoonfuls mustard seed
½ cupful broken cinnamon bark
Several slices horseradish or
¼ cup horseradish

Weight down pickles so they are entirely covered with vinegar. On the two following days, pour off the vinegar, heat to the boiling point and pour again over the pickles. The last morning add horseradish and if the pickles are to be sealed, pack in scalded fruit jars before pouring on the hot vinegar. Seal air tight.

The spiced vinegar may be varied to suit the taste of the individual. The amount of sugar used may vary from one to two pounds for each ½ gallon of vinegar. Any of the spices may be omitted or the amount used varied. One and one-half tablespoonfuls cloves, or 1½ tablespoonfuls allspice can be substituted for one of the kinds of spice in the recipe, or ¾ to 1 cup bought mixed pickle spice used instead of all of the spices mentioned.

Second Method.—Soak cucumbers 24 hours in a brine strong enough to float an egg which is about a pint of salt to a gallon of water. Then pour over them for three successive days the hot seasoned vinegar as given in FIRST METHOD.

Third Method.—Use the following vinegar mixture for 2 gallons of cucumbers:

1 gallon vinegar
2 cupfuls brown sugar
1 cupful mustard seed
1 cupful salt

Mix ingredients, add vinegar and heat sufficiently to dissolve sugar and salt. Cool and pour the cold vinegar mixture over the fresh cucumbers, seal, or cover and weight down in a stone jar.

DILL PICKLES

Pack fresh cucumbers in a scalded stone jar or barrel, placing on the bottom and between each layer a thin layer of dill plant. Pour over them a brine made with 1 pound salt to each 2½ gallons of water. Cover as described under cucumber pickles, observe the same precaution in regard to removing scum and when fermentation has stopped seal with melted paraffin. If additional cucumbers are added more salt must be used. Dill pickles will not be ready for use until 3 or 4 weeks after they are made.

PICKLED SWEET PEPPERS

24 green sweet peppers
½ cupful white mustard seed
1 gallon chopped cabbage
⅓ cupful celery seed

Slice across top of pepper far enough to remove seeds and white sections. Soak 24 hours in brine (2 cups salt to 1 gallon water). Chop cabbage, sprinkle with salt and let stand over night. Squeeze dry, mix with the other ingredients and stuff the peppers. Sew up the cut or fasten it with tooth picks and cover peppers with hot vinegar.

Note.—Peppers may be stuffed with Spanish pickle mixture instead of cabbage or the spiced vinegar such as is used for cucumber pickles may be used instead of plain vinegar.

SPANISH PICKLE

1 doz. large cucumbers
4 heads cabbage
1 peck green tomatoes
1 doz. large onions
½ doz. green sweet peppers
½ doz. small sweet red peppers
3 oz. white mustard
1 oz. celery seed
1 oz. tumeric
2½ lbs. brown sugar
1 gal. vinegar

Chop vegetables fine and sprinkle with 2 cups salt. Put in bag and drain over night. Add spices, sugar and tumeric to vinegar and bring to the boiling point. Add ⅓ teaspoonful cayenne pepper, pour over pickles and seal.

MUSTARD PICKLES

Six quarts vegetables cut in medium size pieces and boiled separately until tender in salted boiling water. Cucumbers, small white onions, cauliflower and string beans make a desirable combination. Carrots, green tomatoes, cabbage, sour pickles, celery and peppers are also used. Drain, then add the hot mustard sauce and seal.

2 qts. vinegar
⅔ cupful ground white mustard
1½ cupfuls sugar
1 tablespoonful tumeric powder
¾ cupful flour

Mix dry ingredients thoroly and slowly add hot vinegar stirring to make a smooth paste. Cook until thick, stirring almost constantly.

CHILI SAUCE

1 peck peeled ripe tomatoes
½ cupful salt
¾ tablespoonful black pepper
12 chopped onions
¼ cup cinnamon
5 cupfuls vinegar
8 sweet green peppers chopped
1½ cupfuls sugar

Boil all ingredients except vinegar for about 2 hours; or until soft and broken, add vinegar and cook until thick, stirring frequently. Can or bottle.

RIPE TOMATO CATSUP

1 peck tomatoes
3 onions
1 lb. sugar
⅓ cupful salt
⅓ cupful cinnamon bark
¼ cupful each mustard seed and whole peppers
2 tablespoonfuls cloves
4½ cupfuls vinegar

Wash and cut up tomatoes. Add 3 peeled sliced onions if desired and cook until soft. Put thru a sieve, add dry ingredients and spices tied loosely in a bag. Boil until about the consistency of apple butter, add the vinegar, cook until of the right consistency, remove bag of spices, and can or bottle.

SAUER KRAUT

Use 1 pound salt to 40 pounds of cabbage. Put layer of cabbage 4 to 6 inches deep in a stone jar with salt and pound to extract juice. Continue until the jar is filled and the liquid comes over the cabbage. Place cabbage or horseradish leaves over the top, cover with weight, cloth and plate. Set aside in a cool place. If mold appears, skim it off and cover the top with fresh brine. Curing takes from 16 to 20 days and is complete when bubbles cease to rise at the side of the jar.

MELON PICKLES

3 cupfuls sugar
3 cupfuls vinegar
2 sticks cinnamon
½ tablespoonful cloves
½ tablespoonful allspice

Watermelon rind, musk melon or chunks of cucumber pulp may be used. Select scarcely half ripe muskmelons, remove outer rind and cut into suitable pieces. Trim off red portion and outer rind of watermelons. Peel cucumbers and remove seeds. Cook until tender in a solution of 1 teaspoonful salt in 1 quart water. Drain thoroly, cook until clear in the above vinegar sirup.

SWEET PICKLED FRUIT

½ peck peaches, pears, or crab apples
2 lbs. brown sugar
1 pt. vinegar
1 oz. stick cinnamon
Cloves

Boil sugar, vinegar and cinnamon twenty minutes. Peaches should be dipped quickly in hot water and peeled. Pears should be pared and left whole with the stem on. Crabs should be culled well washed and have the blossom end removed. Stick each piece of fruit with several cloves. Put into sirup, and cook until soft, cooking one-half of the fruit at a time.

SPICED FRUIT

5 lbs. gooseberries, cherries or currants
4 lbs. sugar
1 pt. vinegar
3 tablespoonfuls ground cinnamon
2 tablespoonfuls ground cloves

Wash and prepare fruit for cooking. Heat sugar and vinegar and skim. Add fruit, cook slowly about an hour and a half or until of the consistency of preserves, adding spices just before canning.

Note.—These Recipes Call for Standard Measuring Cups and Level Measurements.

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COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS

University of Missouri College of Agriculture and the United States
Department of Agriculture Cooperating

P. H. Ross, Acting Director Agricultural Extension Service

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Sewing Processses

Mary E. Robinson

To sew easily and well, a woman should have the right tools for sewing and should keep them in good condition.

SEWING TOOLS AND MATERIALS

1. The sewing machine should be of standard make and should be equipped with hemmer, binder, ruffler, tucker, gauge, quilt gauge and the following tools: oil can, large and small screw-drivers, pinchers, wrench, strap cutter and punch.
2. A dress form made, padded or adjusted to the measurements of the person who will use it.
3. Scissors: (a) Scissors 3 to 5 inches in length with sharp points are used for ripping; (b) shears 8 inches or longer are used for cutting; and (c) buttonhole scissors range from 3 to 5 inches in length. Each pair is equipped with a small screw which regulates the length of the buttonhole.
4. Thimble preferably of silver or celluloid.
5. Pin cushion of cloth stuffed with curled hair, cork or sawdust. Keep this filled with pins.
6. Pins. Dressmaker's steel point pins may be purchased in quarter-pound boxes.
7. Tape measures should be 60 inches in length, ⅜ to ½ inch wide and stitched on both edges. Those tapes that are marked on both sides with the inches numbered from opposite ends are the most convenient to use.
8. A ripping knife or safety-razor blade is used for ripping.
9. Tracing wheels make accurate markers and save much time in basting cotton or linen.
10. Tailor's chalk is used to mark seams. If only one color is bought, buy blue or red so that it can be used on white as well as on colored material.
11. Emery bags are used to smooth the needle when it becomes rusted or rough from the perspiration or oil of the hands.
12. A stilletto is used for punching eyelets and in shaping ends of tailored buttonholes. These may be of ivory, bone or steel.
13. Bodkins are used for running tape thru casings or lace.
14. Needles: (a) Milliner's needles are long needles with round eyes and are useful for basting as well as for millinery work; (b) embroidery or crewel, darning, and tapestry needles have long eyes and are used for

flosses and yarns; (c) sharps are needles in general use in sewing and dressmaking; and (d) ground downs or shorts are used in very fine sewing.

15. Thread: (a) Basting thread is finished with a glazed surface so that it may easily be removed from material (it usually comes in white); (b) sewing thread: Nos. 8 to 200 white, Nos. 30 to 90 colored; (c) linen, Nos. 25 to 250; (d) silk, Nos. E to 000; and (e) silk twist.

NUMBERS OF THREAD AND NEEDLES FOR MATERIALS IN HAND SEWING

Kind of Material	*No. Needle*	*Thread Number*
Very coarse denim, drillings	1 to 3	8 to 24, cotton 4 to 60, linen
Buckram	4	24 to 36, cotton 60 to 80, linen
Heavy Clothing—generally	5	24 to 40, cotton 60 to 80, linen D, sewing silk
Shirtings, suitings and heavy muslins	6	40 to 60, cotton C, sewing silk
Silk and general domestic goods	7	60 to 80, cotton A, B, sewing silk
Soft Linens, muslins and silks	8	70 to 90, cotton A, B, sewing silk
Sheer lawns, linens and muslins	9	80 to 100, cotton 0, sewing silk
Very sheer linens, organdies, chiffons and georgettes	10 to 12	100 to 150, cotton 00 to 000, sewing silk

GAUGES

1. The *hem gauge* (Fig. 1.) is used to secure even width in hems and tucks. This is easier to handle than a tape measure or ruler. The gauge is made from a narrow piece of cardboard about 1 by 4 or 5 inches. Measure down from the end on the long side of the cardboard, the width the hem or tuck is to be made and make a cut about ½ inch long, straight into the cardboard and parallel with the end. Make a diagonal cut just below or just above this straight cut so that a triangular piece is cut out. This notch must be made very accurately, else the width of the hem or tucks will not be correct.

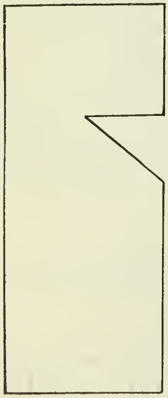

FIG. 1.—A hem gauge

2. The *skirt gauge* is invaluable in taking the length of skirts. There are a number of good skirt gauges on the market. If none is at hand, a ruler, yard stick, stick from a window shade or a tape measure which has had a piece of whalebone stitched in one end, can be used for measuring the desired number of inches the skirt is to be from the floor and the place can be marked with pins.

LENGTH OF THREAD TO USE IN SEWING

A short thread saves time in sewing as it does not knot so readily and is pulled thru the cloth more quickly. A thread about as long as from the end of the middle finger to the elbow is a convenient length to use.

THREADING A NEEDLE

Needles can be more easily threaded if the thread is cut on a slant. Moistening the thread used in sewing may be the means of spreading colds and sore throats; biting may harm the enamel of the teeth. Put the thread into the eye of the needle, holding the needle in the left hand and the thread in the right hand. It is less awkward to do this than to put the needle over the thread. To reduce the number of kinks and twists that get in the thread when sewing, begin to sew with the end which is cut from the spool. If the needle is threaded with the end that is hanging down and this end is left shorter than the one cut from the spool it is easy to start right.

MAKING A KNOT

A knot is used to fasten the thread when gathering or basting. It is seldom used for a permanent stitch except when it can be concealed and when the sewing is being done on heavy material. To make a knot, wind the thread once and a half around the fore finger of the left hand, crossing the thread between the fore finger and the thumb. Roll the thread toward the end of the finger with the thumb to twist the ends together. Then holding the thread taut with the left hand draw the twisted threads down into a knot with the nail of the second finger.

Fastening the thread.—To fasten the thread when the end of the thread or seam is reached, take three or four short stitches on top of each other. This is called a fastening stitch and is used also for fastening the thread when beginning most permanent stitches.

STITCHES

Stitches are divided into two classes, temporary and permanent.

I. **Temporary stitches:** 1. The *basting stitch* is used to hold two pieces of material together until they are firmly stitched. *Even basting* (Fig. 2, *a*) is used when a strong basting is needed as for the seams of a waist that is to be fitted, or for a hem on goods that does not crease easily. These stitches are usually made one-fourth inch long on both the upper and under sides of the material. *Guide* or *uneven basting* (Fig. 2, *b*) is used as a guide for stitching where there is little or no strain. The space between the stitches is longer (three-eighths inch) than the stitch itself (one-eighth inch). *Combination* or *dressmaker's basting* (Fig. 2, *c*) is used to hold together securely two pieces of wool or silk for stitching seams. It is a combination of even and uneven basting. *Diagonal basting* (Fig. 2, *d*) is used to hold two pieces of cloth together securely as in basting a lining to a collar, cuff, etc. This stitch varies in length (one-fourth inch to two inches) according to the purpose for which it is used.

2. *Tailor's tack* or *mark stitch* (Fig. 2, *e*) is used to mark seams in tailored garments so that both sides of the garment will be exactly alike in con-

struction, to mark plaits and to mark similar pieces cut by a commercial pattern so that the various parts may be more easily matched. The mark stitches or tailor's tacks are made by using a double thread and basting thru a double thickness of cloth. Take two even basting stitches, then skip one-half to three-fourths inch and take two more stitches, leaving a loop of thread of one inch to one and one-half inches between every two. Then separate the two pieces of material and cut the threads between them. In this way both pieces of the garments are marked exactly alike.

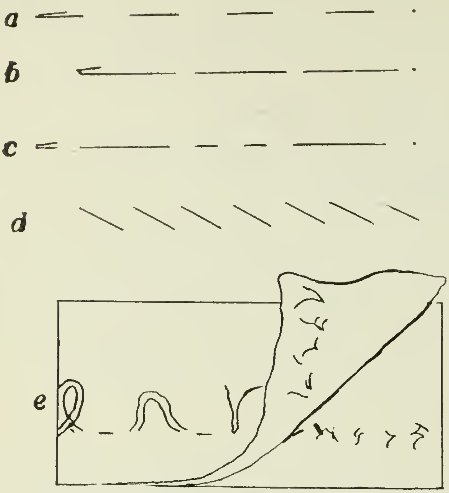

FIG. 2.—Temporary stitches: *a*, Even basting; *b*, uneven basting; *c*, combination basting; *d*, diagonal basting; *e*, tailor's tack

II. **Permanent Stitches:** 1. The *running* or *gathering stitch* (Fig. 3, *a*, *b*) is used for gathering, for tucking and for seams that do not require strength. These stitches are very small and may be even or uneven. Uneven running stitches are desirable when there is a good deal of fulness to be gathered into a small space. To make a running stitch take a small stitch on the point of the needle and place the first finger of the right hand on the underside of the cloth at the point of the needle, the thumb on top and the middle finger with a thimble on it at the end of the needle. With the left hand hold the edge of the cloth about one inch from the point of the needle. Pull gently with the left hand, turn the right hand slightly back and forth and push the needle thru the taut cloth. After several stitches have been taken move the position of the hands along but do not pull the needle thru until as many stitches as possible have been taken on the needle. Begin and end running stitches with a fastening stitch except when used for gathering, when a knot can usually be used at the beginning. At the end allow the thread to extend several inches beyond the cloth and put a knot in the end of it.

2. A *backstitch* (Fig. 3, *c*) is used for sewing seams by hand where much strength is required. It is the best stitch to use in sewing up rips in top seam gloves. To make this stitch, first take a very short stitch, then put the needle back to where it was first put into the material and bring it out a space beyond the stitch which is the same distance as the length of the stitch. Take the second stitch by putting the needle back to the end of the last stitch and bringing it out the same distance beyond. Always advance from the underside of the material, making the under stitch twice the length of the top stitch. When carefully done with small stitches, backstitching closely resembles machine stitching. Begin and end backstitching with a fastening stitch.

3. The *combination stitch* (Fig. 3, *d*) is a combination of the running stitch and the backstitch. It is made by using a few running stitches with an occasional backstitch. This stitch is used for a seam where more strength is needed than is given by the use of a running stitch.

4. *Overhanding* (Fig. 3, *e*) is used to join two finished or folded edges such as selvedges, bottom of hems, lace, ribbon, embroidery, beading, etc., or in making hems in napkins or table linens. This stitch insures a flat seam and a damask hem in which the stitches show little because they are taken straight across the hem and lie in the same direction as the threads of the damask. After basting the edges together, the material is held in the left hand with the edges along the fore finger. The needle is inserted at a right angle to the edge and pointed directly toward the worker. The stitches are taken very close together and just deep enough to catch the material. Overhanding may be begun and ended with fastening stitches or the end of the thread may be laid along the top and caught with the first four or five stitches, and fastened at the end by reversing the material and sewing over the last four or five stitches.

5. *Overcasting* (Fig. 3, *f*) is making a large stitch over a raw edge to keep it from raveling. Hold the raw edge diagonally across the first finger of the left hand. Bring the needle thru from the back of the goods each time about ⅛ inch down and ¼ inch from the last stitch, letting the thread fall over the edge of the cloth. Begin and end by taking small fastening stitches ⅛ of an inch down from the raw edge.

6. *Hemming stitch* (Fig. 4, *a*). To make a hemming stitch, hold material across the first finger of the left hand with the bottom of the hem toward the palm. Hemming is done toward the worker and the needle is slanted slightly to the left. Since the hemming stitch is a slanting stitch the needle should not be placed straight across

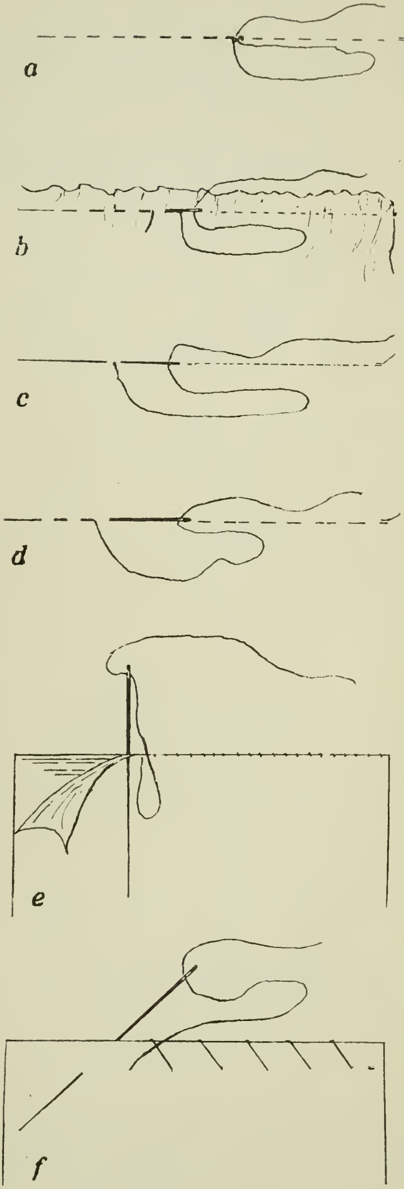

FIG. 3.—Permanent stitches: *a*, Running; *b*, gathering; *c*, backstitch; *d*, combination; *e*, overhanding; *f*, overcasting

the hem. To make a small stitch place the needle under the fold of the hem, catch a few threads and bring it thru the very edge of the fold of the hem. When working with silks or materials where close stitching is not desired, the stitch may be made according to the foregoing directions, but the distance between these stitches should be increased. If this stitch is not taken thru to the right side but only enough thread is caught on the needle to hold, this is called *blind hemming.* Begin and end the hemming stitch with fastening stitches taken only thru the hem.

CONSTRUCTIVE PROCESSES OTHER THAN STITCHES

Hems.—A hem serves as a finish for a garment or as an ornament.

1. The *plain hem* (Fig. 4, *a*) is made by twice folding the edge to be hemmed, the first fold being very narrow and the second the width of the desired hem. The first turning of a hem varies from one-eighth to one-fourth inch in width depending on the width of the second fold. The width of narrow hems may be gauged by the eye but wider hems must be measured with a gauge or other marker. Hems of skirts must be marked when the garment is on the person for whom it is intended. Mark with pins or tailor's chalk the desired distance from the floor, turn the skirt at the mark, baste, trim the turned edge so that it is the same width all around. Turn a ¼-inch fold and baste the hem in place. If there is extra fulness in the hem lay it in tiny plaits. The second fold is first basted securely into place and then fastened down with machine stitching or with a hemming stitch. The ends of hems on aprons, towels, etc., should be overhanded.

2. The *napery* or *French hem* (Fig. 4, *b*) is used on table linens and similar materials. To make this hem, crease the material as for plain hem, then turn the hem back on the right side, and overhand.

3. The *rolled hem* which is whipped (Fig. 4, *c*) is used on sheer materials when insertion is set in, lace is applied or for making very narrow hems on sheer ruffles, handker-

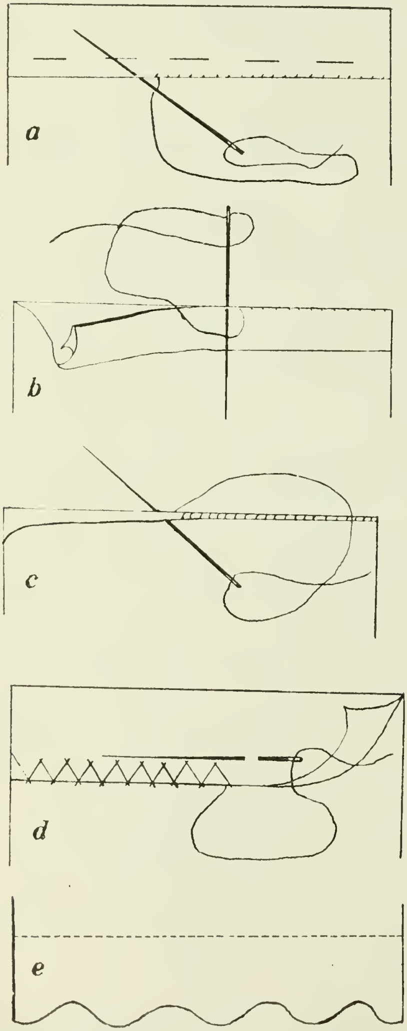

FIG. 4.—Hems: *a*, Plain; *b*, napery or French; *c*, rolled; *d*, flannel; *e*, shaped

chiefs or collar edges. This hem is made by trimming the edge of the material evenly, then, with the wrong side toward the worker, rolling the edge tightly with the thumb and first finger of the left hand. The needle is slanted toward the left, the stitch going under and over the roll, thus keeping the raw edge from showing. Rolled hems on handkerchiefs or collar edges are often whipped in both directions, the stitches crossing each other.

4. The *flannel hem* (Fig. 4, *d*) is used in making flannel petticoats or woolen garments. The raw edge is not turned in but is held in place with a catch stitch on the wrong side. The right side may be finshed with some simple decorative stitch. To make a catch stitch take a small stitch ⅛ inch on the fold of the hem, then one on the cloth just beyond the raw edge, etc., pointing the needle toward the worker, and advancing away from the worker.

5. The *shaped hem* (Fig. 4, *e*) is used in finishing undergarments. To make this hem, turn the material up on the right side after the desired length has been taken. Then mark off the scallops the desired shape and size, stitch and cut around the scallops ¼-inch below the seam. Turn the hem so that the scallops will be right-side out. Baste securely and stitch on both the edge of the scallops and at the top of the hem. If desired a decorative stitch can be used at the top of the hem.

Mitred and cut-out corners (Fig. 5) are used in hems, facings, laces, embroidery, etc., where an abrupt turn is made and there is surplus material To miter the corners of a hem, first turn the hem in the ordinary way and crease. Cut a triangular piece from the material at the corner, the base of which will be ⅛ inch above the meeting of the creases made by the top folds of the hem. Turn down the ⅛ inch on the diagonal cut and overhand or seam the miter together on the wrong side. To make a cut-out corner crease the hem and cut an oblong piece from the under fold leaving ⅛ inch along the side and bottom of the hems. Turn back the hems, hem and overhand the ends of the hems.

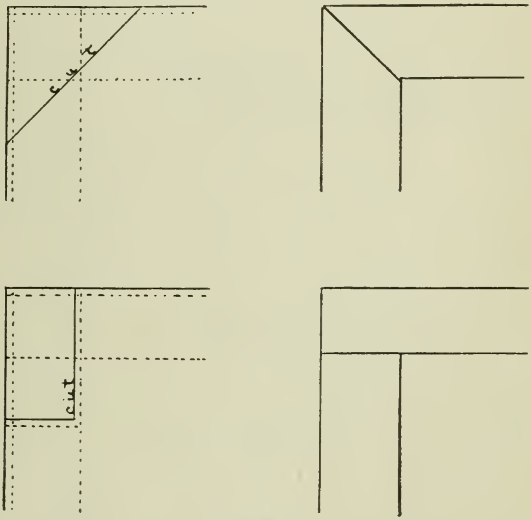

FIG. 5.—Corners: Mitered and cut-out

Seams.—1. *Plain seams* with finished edges are used principally in making outer garments. To make this seam, place the right sides of the material together and baste ¼ to ½ inch from the edge. Stitch just outside the basting and remove all basting threads. The raw edges of the seam may be finished by notching, overcasting, binding or in soft material the edges may be turned in and secured by a running stitch. In ginghams or heavier cotton materials the seams may be stitched again about ¼ inch from the first stitching and the edges trimmed off to the second stitching.

2. *Overhanded seams* are used for joining finished edges as selvedges or folded edges when a very flat seam is desired as in some piecing.

3. The *French seam* (Fig. 6, *d*) is used in making undergarments, and outergarments that are made of light weight materials. To make this seam, allow ⅜ inch for materials which do not ravel, and ½ inch for materials which ravel. Pin and baste together the materials and make the first stitching on the right side of the material ⅛ to ¼ inch from the edge. Trim to ⅛ inch and press seam flat on the right side. Then reverse the fold so that the seam edges come within the fold, crease, and stitch 3/16 to ¼ inch from the edge. This row of stitching must entirely cover all raw edges from the first stitching. This seam may be used in handmade garments, the running stitch being used for the first stitching, the combination or backstitch for the second.

4. *Felled seams.* To make this seam, stitch a seam about ⅜ inch wide. Trim the underside of the seam to ¼ or ⅛ inch; the upper side to ¼ to ⅜ inch. Fold the wide edge down about ⅛ inch over the narrow edge, turn both edges down flat to the cloth and baste down the folded edge. Care must be taken to push back the material as the folded edge is basted down so as to prevent any pucker on the right side. There are several kinds of felled seams.

(a) Hemmed fell seams (Fig. 6, *a*) are used in underwear and baby clothes. The seam is stitched on the wrong side and the fold is hemmed down by hand.

(b) Stitched fell (Fig. 6, *b*) is made like the hemmed fell except that all stitching is done by machine. The seam is always finished on the right instead of the wrong side of such outside garments as men's shirts, boys' clothing, middy blouses, tailored waists or skirts.

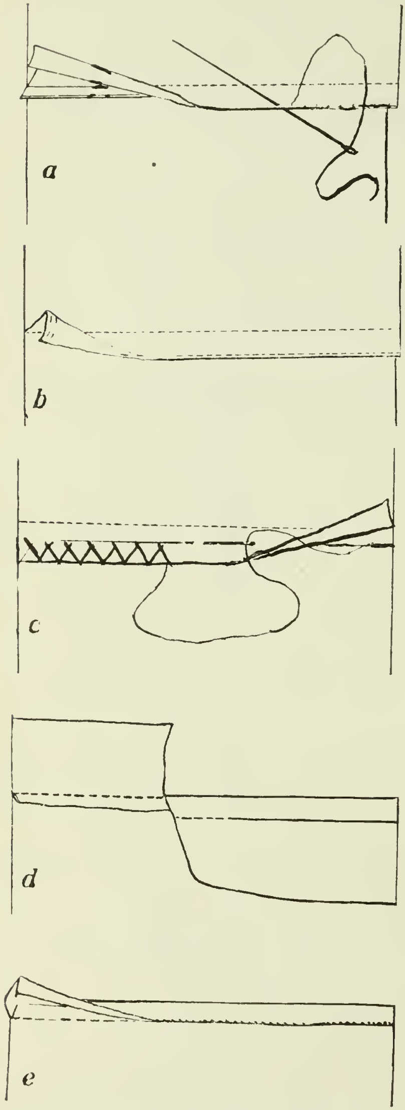

Fig. 6.—Seams: *a*, Hemmed fell; *b*, stitched fell; *c*, flannel fell; *d*, French; *e*, French fell or self-bound.

(c) Flannel fell (Fig. 6, *c*) is used in making infants' flannel petticoats. To make this seam, place two right sides of material together; stitch a seam ¼ inch from the edge. Trim the underside to ⅛ inch and baste a fell without folding down the upper edge. Catch-stitch the raw edge to the garment.

(d) Standing fell or self-bound seam (Fig. 6, *e*) may be used in waists of soft material that have been fitted with seams on wrong side; for joining unlined cuffs to a sleeve; for putting in beading or embroidery insertion, etc This seam is found on most ready-made underwear because it can be made with one stitching, thus saving thread and labor. To make this seam, begin as for a hemmed fell but if material frays stitch seam ½ inch deep. Trim one edge ⅛ inch, turn a narrow fold in the upper edge and bind the seam with this edge. Hem by hand or stitch. This seam is not stitched flat, hence the hemming stitches do not show on the right side. The first seam can be basted and not stitched if the folded edge is carefully basted just over the first line of basting and is stitched on the machine.

Bindings are used for finishing separate collars and cuffs, armholes and some other seams, especially those on heavy materials, and for decoration. Bindings used for decoration may be tailored in effect as in wash or woolen materials or soft as in georgettes and soft silks. Bias materials should always be used in bindings. Cut the binding twice the depth of the finished fold, plus ¼ to ½ inch for seams. When the strips of bias material have been joined baste them to the right side of the garment or seam. Stitch or run by hand according to the material, then fold down the other edge once and turn to the wrong side so the folded edge just covers the first stitching, and blind stitch or stitch by machine according to the effect desired.

Facings or false hems may be used in finishing undergarments and outer garments at neck, sleeve, etc., in finishing the bottom of a circular or two-piece skirt, for lengthening skirts, and the like. Material used to face a garment is sometimes cut straight, but is more often cut bias. Bias facing may be purchased by the yard or cut from the same material of which the garment is made. Unless ready-to-use bias facing is of very good material, the facing which is used should be cut from the same material as the garment. To apply a facing lay the right side of the facing to the right side of the edge that is to be faced, baste and stitch. Turn to the wrong side and finish as a hem. The facing is usually turned exactly at the seam. On a circular edge as a round neck, circular skirt, etc., a fitted facing is sometimes used. Before cutting such a facing trim the edge to be faced as it should be when finished, plus ¼ inch for the seam; lay the right side of this edge on the right side of the facing material so that the garment lies flat and smooth. Baste with a diagonal basting and cut the facing exactly along the edge which is to be faced. Measure up on the material the width the facing is to be finished plus the turning; mark with a pencil and cut. Stitch along the bottom of the facing; turn to the wrong side and finish as a hem.

Cutting Bias.—Bias material which is used in trimmings, facings, or bindings should be cut on the true bias; that is, the material should be cut in strips diagonally across the warp and woof threads. To do this, lay a corner of the material at right angles to itself so that the warp threads are parallel with the woof threads. Crease this fold. Then unfolding the material draw a line along this crease with a pencil or tailor's chalk and yard stick. Measure at right angles to the line the depth desired for bias strips. Do this at intervals along the strip and work with chalk or pencil. Draw a line thru the marks with the aid of a ruler. Repeat until the required number of strips have been measured and then cut. Join the bias strips by hand or machine, according to the material used.

Ruffles are cut on the bias or crosswise of the goods. They may be applied in any one of the following ways: Stitched on the right side and the raw edge covered with a tuck, a bias strip or finishing braid; put into a hem the edge of which is slit; joined to another edge with a facing, French, bound, or French fell seam; hemstitched flat by machine after the raw edge of the ruffle has been turned once; rolled, whipped and overhanded to a finished edge, if ruffle is of very soft material; stitched with a heading made by folding the material once or putting a narrow hem at the top of the ruffle and stitching ¼ to ½ inch from the top of the ruffle.

When applying a ruffle or other gathered edge, it is easier to divide the ruffle into two or four parts and gather these divisions with separate threads. A gathering thread should not be fastened, but should be left long and have a knot in the end. Divide the edge of the garment to which the ruffle is to be applied into as many divisions as the ruffle has been gathered, pin the ruffle into place, draw up the gathering thread until it is just as long as the space to which the gathers are to be applied and wind thread several times around the point and head of the pin. Baste and stitch. Gathers can be applied more neatly and evenly if a second gathering thread is run just ¼ inch below the first row or if the gathers are pulled up tightly and stroked or laid under the thumb in little folds with the head of a needle.

Applying lace and embroidery.—Embroidery insertion is usually applied with a French fell or a flat fell seam or if there is a beading on the edge of the embroidery, the plain material can be trimmed to the beading and the edge overhanded to lace or other finished edge. To join embroidery, match the pattern and use a hemmed fell seam, a French seam, or a plain seam with the two raw edges buttonholed together.

Beading or entre-deux can be applied with a French seam, a French fell seam or if cut can be overhanded to any finished or rolled edge.

Lace may be overhanded to a finished edge as beading or other lace, to a folded edge as a hem, or to a rolled edge. To join lace that is coarse or ravels easily, make a hemmed fell or stitch in a seam and buttonhole the two edges together. To join fine lace lap so the patterns match, and baste; sew around one side of the pattern and thru mesh with fine hemming and an occasional buttonhole stitch; trim the ends of the lace away close to the buttonhole stitches. When sewing edging around a corner allow twice the width of the edging for fulness.

Plackets.—Plackets should be finished so that the right side of the garment will lap over the left side.

1. A *hemmed placket* is used in petticoats that have some fulness in the back. This is the easiest placket to make. The slit is cut and a hem ¼ inch wide made on the left side of the slit and ½ to ¾ inch on the right side. The right side is lapped over the left side the width of the upper hem and a double row of stitching is made diagonally upward from left to right at the end of the placket.

2. A *bound placket* (Fig. 7, *a*) may be used for both under and outer garments. To make this placket, cut a lengthwise strip of material twice the length of the placket and twice the desired width of the finished binding plus the seams. One and one-half to two inches is the usual width for this strip. Place the right side of the binding to right side of garment and baste with a narrow seam around the entire opening. Stitch by machine, holding garment on top to avoid stitching in folds of material. Make ¼ inch turning on other edge of binding, bring this fold just to cover first stitching, baste and stitch. After the stitching is done, turn the binding on the right-hand side of the placket back against the wrong side of the garment and catch with the band.

3. The *bound and faced placket* (Fig. 7, *b*) is used for undergarments. To make this placket start just the same as if making a bound placket. When the binding has been stitched around the first time make a ¼ inch turning and bring fold back to stitching and crease just as if a bound placket were to be made. Before basting cut out the underneath part of the binding on the right-hand side of the placket leaving ⅛ inch inside of the crease at the side and bottom. Face the right-hand side of the placket with the binding which has had the extra thickness cut out, and bind the left-hand side of the placket. Stitch diagonally across the lower end of the right side of the placket upward from left to right.

4. *Shirt-sleeve placket* (Fig. 7, *c*).—Cut the openings as long as desired. This is usually 4 inches long and 1 inch past the fold on the under side of the sleeve. On the right side of the sleeve sew a dart ⅛ inch wide beginning just at the end of cut and running off to nothing ½ inch straight above. To make the placket, use a lengthwise strip of goods 3 inches wide and twice the length of the opening. Sew around the opening with right side of facing to wrong side of sleeve. Fold this facing back on the under side of sleeve at seam and baste on right side. Trim facing to ⅞ inch as far as opening. Clip facing in ⅛ inch, turn ⅛ inch and baste flat to sleeve. Measure fac-

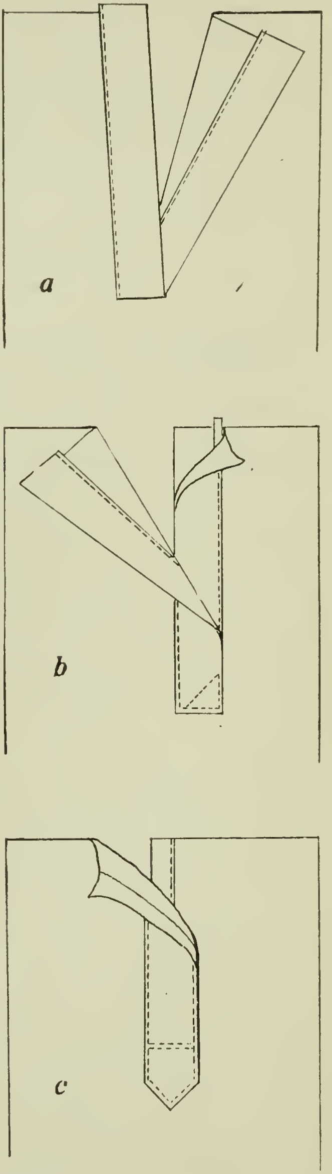

FIG. 7.—Plackets: *a*, Bound, wrong side; *b*, bound and faced, wrong side; *c*, shirt-sleeve, right side

ing sewed to upper part of sleeve 5½ inches from the bottom of sleeve and cut facing straight across. Trim edges so as to form a point, cut away unnecessary cloth and baste to place. Stitch close to edge of facing and twice across at the top of opening ⅛ inch apart, and deep enough to catch raw edge.

Bands.—Cut bands lengthwise of the goods twice the desired width plus seams, and the length desired plus seams and the amount that is to be lapped. Find the middle of band and middle of edge which is to be banded. If edge to be banded has a placket which extends an inch or more allow for this when finding center of band. Place right side of band to wrong side of garment and pin together at center and at ends, allowing band to extend ¼ to ½ inch beyond ends. If there are gathers use the same method as in applying a ruffle. Baste and stitch. Turn the upper edge of the band down once and the ends in, turn band to right side and baste the fold so that it just covers the first stitching. Stitch in place and stitch or overhand the ends. If bands are hemmed down by hand they are first stitched on the right side then turned to the wrong side to be hemmed.

Fastenings for garments.—In general, buttons should be used on wash materials, hooks and eyes and snap fasteners on silks and woolens.

1. The *buttonhole* (Fig. 8) should always be made on double material on the right side of the garment. Use silk twist for making buttonholes in wool or silk and heavy thread suitable for the weight of cotton material. Always use a long enough thread to complete all steps in the working of a buttonhole.

(a) Cutting the Buttonhole.—Buttonholes should be cut so that the pull comes in the end rather than on the broad side of the hole. For instance, buttonholes in the band of a petticoat that buttons on to a loose waist should be cut up and down while buttonholes on a petticoat that buttons around the waist should be cut crosswise, which will be lengthwise on the band. Buttonholes in the hem of a waist that buttons behind are cut crosswise. The only exception to this rule is when buttonholes are made in the plait of a man's shirt or a woman's tailored waist which is starched. Since there is no particular strain on buttons in such a plait the buttonholes are cut up and down so that the button can be slipped into the buttonhole more easily without mussing the plait.

Select the size of the button to be used and cut the hole accordingly. Buttonhole scissors are very convenient for cutting the hole. If these are not at hand cut the hole in the following way: Fold the material and, with a pin, mark half the width of the button from the fold of the material. Then holding the folded material firmly make a short cut just long enough to insert the point of the scissors. Release the fold and cut in each direction exactly along the thread and a little past the pin holes. A buttonhole needs to be cut about $^1/_{16}$ inch longer than the width of the button.

(b) Preparing the Buttonhole for working.—Slits for buttonholes may be stitched, stranded, overcast, stranded and barred, or barred and overcast, depending upon how the buttonhole is to be finished and upon whether the material frays easily. For the buttonhole shown in Fig. 8, *d*, barring and stranding or barring and overcasting is recommended. For the buttonhole shown in Fig. 8, *e* or *f*, stitching, stranding or overcasting may be used. Overcasting is always used on materials that ravel easily. Stranding helps to hold the two thicknesses of material together. It is made by taking a stitch at each end of the buttonhole so that a long thread is carried along each side. Sometimes small running stitches are used on each side in place of a long thread, or a rectangle ⅛ inch wide is stitched around the place where the buttonhole is cut. Barring is necessary when the ends are not worked in order to give extra strength, and such barring stitches are put in when the buttonhole is stranded or overcast. Bars that are worked are put in when the buttonhole stitch is being made. To bar for a buttonhole with unworked ends, take the three short stitches across each end, just inside of where the buttonhole stitches will come on the sides, with the same thread that is being used for overcasting or stranding. Pull the first two of these stitches tight, drawing the slit which has been cut for the buttonhole firmly together.

(c) Working the Buttonhole.—After the buttonhole is cut and prepared, begin to make the buttonhole stitch at the back of the buttonhole or the end against which the button will not pull.

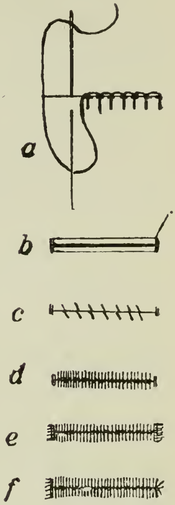

FIG. 8.—The buttonhole: *a*, Buttonhole stitch; *b*, stranded and barred; *c*, overcast and barred; *d*, plain unworked bar ends; *e*, worked bar ends; *f*, fan and worked bar end

The buttonhole stitch (Fig. 8, *a*) is made by inserting the needle just beyond the stranding or overcasting threads, bringing it to the right side of the garment. Be sure that the thread which comes from the edge of the material is always kept back of the needle. Before pulling the needle thru, pass the thread from the eye of the needle under the point of the needle from right to left. If the worker is left-handed or is working from left to right throw the thread under the point from left to right. Draw the needle thru and away from the worker so that the thread is pulled at right angles to the edge and so that the purl or double knot which the stitch makes is along the cut edge. Keep the stitches as nearly the same depth as possible, the distance of one thread apart and as shallow as they can be made without pulling out the material.

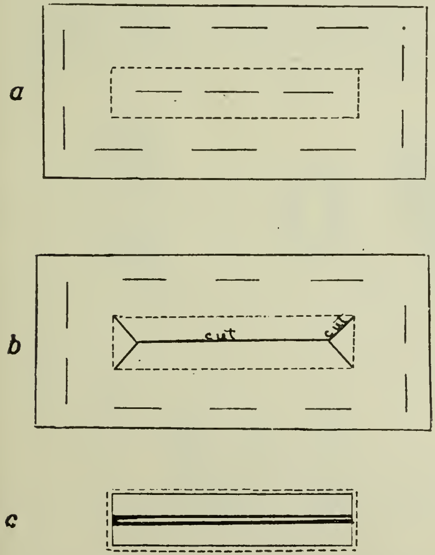

FIG. 9.—Bound buttonhole: *a*, Stitched; *b*, stitched and cut; *c*, finished

There are three finishes which may be used for the ends of the buttonhole: the fan, the worked and the unworked bar. The fan is made in the end of the buttonhole where the button will rest. It is made by continuing the buttonhole stitches in a fan shape around the end of the hole as in Figure 8, *f*. The worked bar is usually in the opposite end from the fan to prevent the tearing of the buttonhole in a shirt plait. This is made by taking two or three stitches across the end to be barred, and then applying a close blanket stitch as shown in Figure 8, *e*. The unworked bar (Fig. 8, *d*) does not make as strong an end as either the fan or worked bar, but it is strong enough for ordinary purposes and is easier to make. The bar is put in when the buttonhole is being prepared and no stitches are made over the bar. When the buttonhole is finished the needle is put thru the purl on the opposite side and fastening stitches are made on the wrong side of the garment near the buttonhole.

(d) Bound Buttonholes are used both for ornamentation and for practical use. To make a bound buttonhole, first baste a strip of bias material about 2 inches longer than the length of the buttonhole and 1½ inches wider over the place where the buttonhole is to be made, placing the right side of the bias material to the right side of the garment. If the binding material is soft or apt to stretch use a straight instead of bias piece for binding. Mark the place and length of the buttonhole with a pencil line or basting stitches. Stitch all around this line making the two rows of stitching $^{3}/_{16}$ to ¼ inch apart and turning square corners at the end of the buttonhole. Cut exactly in the middle between the two rows of stitching to within almost ⅛ inch of each end. From these points make cuts toward each corner, as in Figure 9, *b*. Remove the basting and push the binding thru to the wrong side. Fold so that binding is even on both sides and edges just touch; baste and stitch on the right side on the very edge of the fold that joins the binding. If material is soft or if machine stitching is not desired a straight strip of cambric or lawn should be basted to the underside of the garment before the buttonhole is made. This stays the material and the binding when pushed thru can be fastened to the strip with running stitches.

2. *Buttons.*—When the buttonhole is made, find the place to sew on the button by lapping the end of the band or plait as it should be and sticking a pin at the outside end of the buttonhole. Remove the pin and fasten a double thread at this place with several small stitches or a knot. Put the needle thru

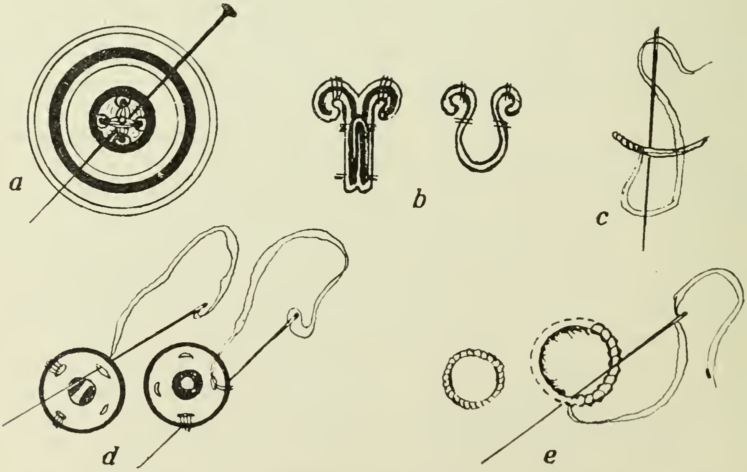

FIG. 10.—Fastenings: *a*, Buttons; *b*, hooks and eyes; *c*, loop; *d*, snaps; *e*, eyelets

one of the holes, place a pin on top of the button and sew back and forth across the pin. (Fig. 10, *a*.) Remove the pin, then wind the end of the thread several times around the loose threads between the button and the cloth and fasten the thread on the wrong side underneath the button. Sewing over a pin helps to prevent the button from pulling off in the wash and tearing the cloth, and makes it easier to put the button into the buttonhole.

3. *Hooks and eyes.*—Place the hooks on the right side of the opening, the eyes on the left, each far enough back so that they will not show when the garment is fastened. Sew in place with neat over-and-over stitches as shown in Figure 11. The blanket stitch may be used at the circular ends, but the added neatness and strength scarcely pay for the extra time.

4. *Snap fasteners* are sewed neatly and securely with several over-and-over stitches. Carry the thread from one hole to the next underneath the snap and not across the top of it.

5. *Eyelets* are made by putting a running stitch around the place where the eyelet is to be, then punching a hole in the material with a stiletto or other round, pointed tool and strengthening the edges with close overhanding stitch, buttonhole stitch with purl on outer edge, or purl on inner edge.

6. *Loops* are made by tacking three or four stitches back and forth over a strip of cardboard the width that is desired for the finished loop. These threads are completely covered with a blanket stitch made very close together in order to strengthen the loop and with the purl at the bottom of the loop. Slip the cardboard out when the loop is finished.

SIMPLE DECORATIONS

The decorations of a garment need not be elaborate or expensive. Simple embroidery or self-trimmings add to the appearance of garments.

Self-trimmings.—A garment may be made very attractive and money may be saved if the trimmings used are of the same material as the garment itself. Following is a suggested list of self-trimmings:

pipings
folds
bindings
cordings
shirrings
tuckings
plaitings
pockets
bound buttonholes
buttons
reversed hems
ruffles

Simple embroidery.—If the right colors and materials are chosen, a touch of simple embroidery often adds to the distinctiveness of a garment.

1. *Machine couching* is used to decorate children's clothing, women's dresses, skirts or underwear. It is usually made on a machine which has a rotary ribbon. The bobbin is filled with the color and weight embroidery floss desired. Usually a very heavy floss is chosen in order to secure a cord-like effect. Fill the machine with ordinary sewing thread. Loosen the tension and lengthen the stitch of the machine. Stitch the garment to be decorated on the wrong side of the hem or facing

2. The *outline stitch* (Fig. 11, *c*) is made from the worker. Put the needle in almost straight with the line that is being worked and take up just half the length of stitch wanted, bringing needle out each time at the end of the previous stitch. To start the stitch take several small running stitches along the line on which the outline stitch is to begin, ending them at the starting point. Finish the stitch by taking several stitches thru the wrong side of the outline stitches.

3. The *chain stitch* (Fig. 11, *a*) is made toward the worker. Bring the needle up thru material, hold thread down with left thumb, put the needle back

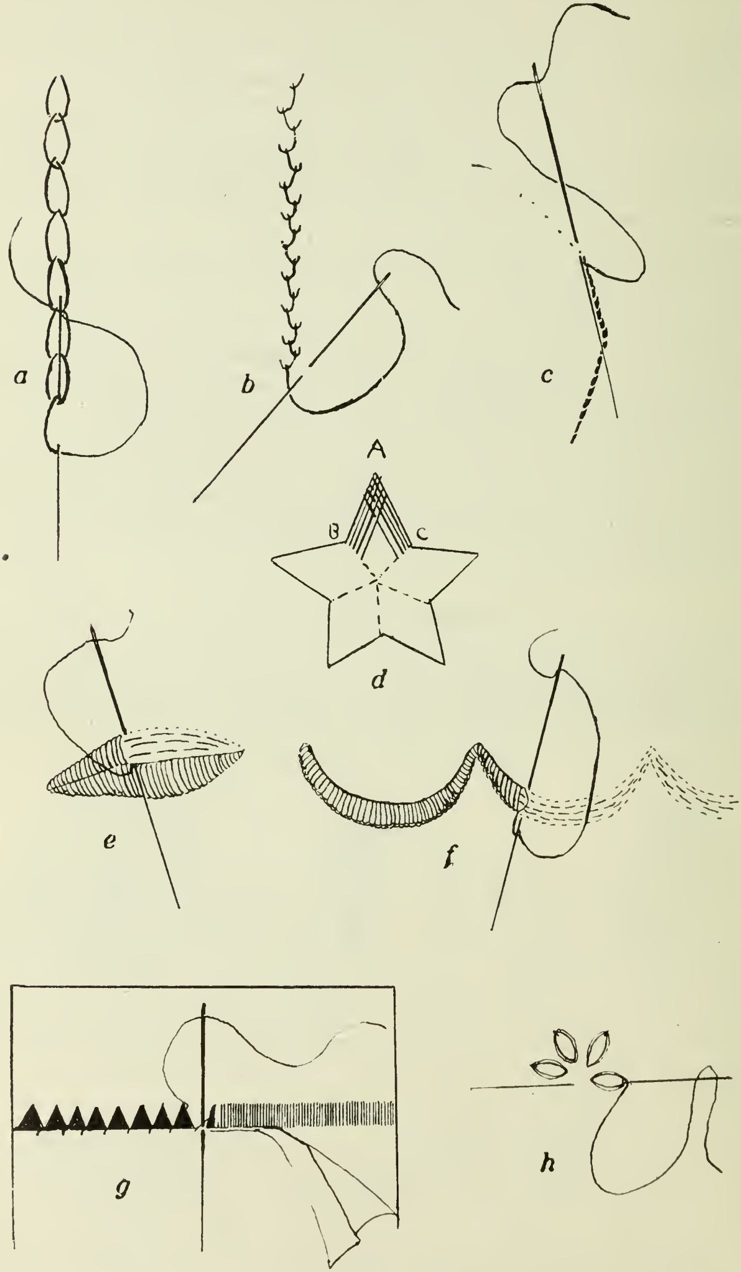

FIG. 11.—Decorative stitches: *a*, Chain; *b*, feather; *c*, outline; *d*, star; *e* satin; *f*, scallop; *g*, hemstitch; *h*, lazy daisy

a thread or two next to the hole it just came thru, and bring it out a short distance in advance and over the thread which is thus held down in the form of a loop. A knot may be used for fastening the thread at the beginning, or small fastening stitches used at both the beginning and ending.

4. The *lazy daisy stitch* (Fig. 11, *h*) is a variation of the chain stitch. Two stitches only are needed for each petal of the daisy. The first is a chain stitch, the second is taken thru the material at the tip of the petal but just outside of the chain stitch to hold the first in place.

5. *Blanket stitches* (Fig. 12) are used to finish the edges of flannels and other woolens or for scalloped edges or decoration. The stitch may be made any desired depth or combination of depths and any desired distance apart. For making scallops when embroidering, the stitches are made as closely together as possible. The edge of the material is held next to the worker and the stitch is made from left to right. Fasten the thread by making a fastening stitch where it will not show and bring the thread out as near the edge as possible. Let the thread fall naturally to the right or hold it down with the left thumb. Put the needle in at the desired depth and bring it out at the bottom of the scallop or over the raw edge and so that the thread is underneath the point of the needle. Pull the needle thru. The thread should be continuous along the edge.

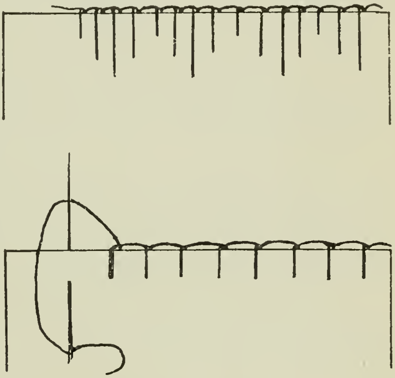
FIG. 12.—Blanket stitches

6. *Feather or briar stitches* (Fig. 11, *b*) are variations of the blanket stitch made first on the right side, then on the left. These stitches make beautiful and effective trimmings and may be varied by putting the needle in straight or slanting, and by taking one, two or three stitches on each side before working on the other side. The stitch is made toward the worker. Bring the needle thru from underneath; hold the thread down with the left thumb; put the needle in ⅛ inch or less to the right of where the thread came out and bring it thru, making a stitch about ⅛ inch long. Bring the needle out over the thread so that a blanket stitch is formed. To make the left-hand stitch, the thread must be thrown to the left so that it will be underneath the point of the needle when the stitch is taken.

7. The *cross stitch* (Fig. 13, *c*) may be made over the threads in loosely woven materials such as scrim, monk's cloth, etc. In fine materials canvas must be basted into place, the stitches made over this and the canvas removed by wetting it to soften the glue and pulling out the threads. If a pattern is stamped upon the material no canvas is needed. The stitch may be made by bringing the needle thru at the upper left-hand corner of the square, then taking a stitch by putting the needle in at the lower right-hand corner and bringing it out at the lower left-hand corner, putting it in at the upper right-hand corner and bringing it out at the upper left-hand corner of the square at the left of the one upon which the cross stitch has been completed. When canvas is used the stitches are crossed over the threads of the canvas. Every alter-

nate row the pattern should be inverted so the work can always be done from right to left, but care must be taken always to cross the threads in the same way or an attractive design will not result.

8. *Couching* (Fig. 13. *a*) is a decorative stitch which may combine different shades or colors very attractively. Two threads are used in making this stitch. One is held in place on the material with the left hand. The second thread is used in making the stitches which hold the first thread in place. These stitches are made over the first thread and at right angles to it and are made ¼ to ½ inch long on the wrong side.

9. The *French knot* (Fig. 13, *d*) is made by bringing the needle thru the material where the knot is desired, wrapping the thread around the point of the needle one or more times while holding the thread taut, and putting the point of the needle down into the cloth very near where it came thru before. The twist of the thread is pushed down close to the cloth and held there while the needle is pulled thru to the wrong side.

10. The *satin stitch* (Fig. 11, *e*) usually has a padding made of running or chain stitches or of floss laid along the part that is to be covered with satin stitches. The padding is always made at right angles to the direction in which the satin stitches are to be made. The material should be held so that the stitch can be worked vertically and the work progress from left to right. The stitches should be exactly parallel and close together and the outline of the decoration should be unbroken.

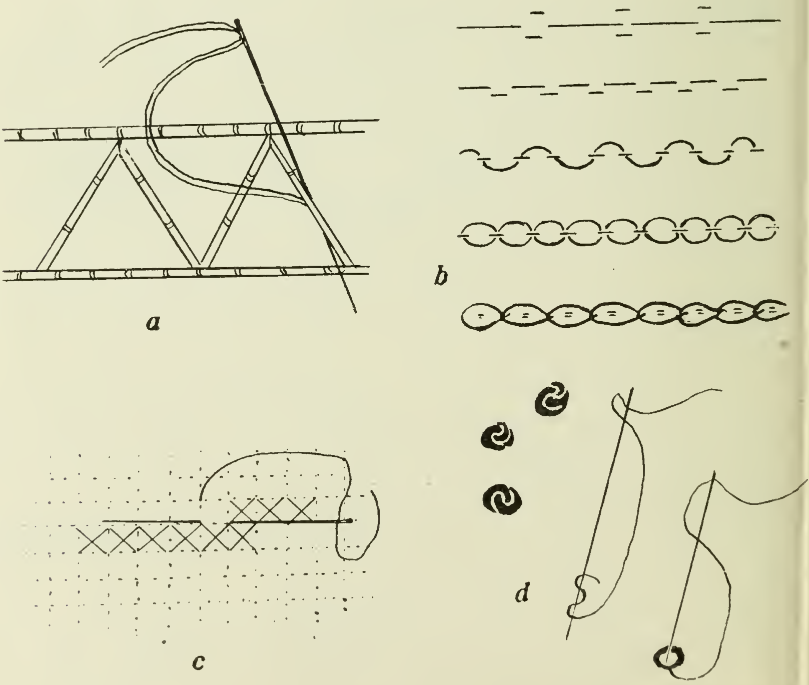

FIG. 13.—*a*, Couching; *b*, simple decorative stitches; *c*, cross stitch; *d*, French knots

11. The *arrow-head tack* (Fig. 14) is used on such garments as sailor suits, middy blouses and tailored suits. To make this stitch fasten the thread with a few running stitches ending at *A*; put the needle down thru the material at *B* and up again at *B* at the right of stitch just made, down at the right of *A* and up at the left of *A*, passing the needle each time over all of the stitches from *A* to *B* except the last one, and under that. Then put the needle thru to wrong side at *C* up again at the left of *C* down again at the left of *A* and up at the right of *A*, down at the right of *B* and up at the right of that stitch. Continue the stitches in this way until the arrow head is completed.

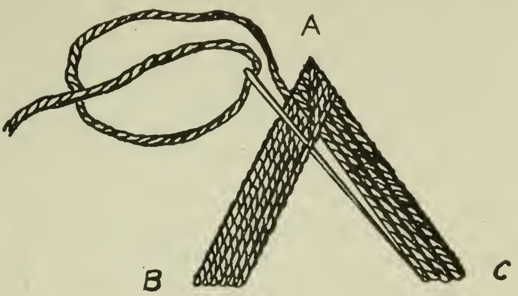

FIG. 14.—Arrow-head tack

12. The *star* (Fig. 11, *d*) used on sailor collars can be made in very much the same way as the arrow head. Each point is worked separately but instead of placing the stitches at *B* and *C* forming a straight line, each succeeding stitch at *B* or *C* is placed a little lower down and farther in so that the stitches come together at a point in the center of the star.

13. *Hemstitching* is an open work finish used at the top of a straight hem. To make this finish, draw threads where the top of the hem will come when it is folded the desired width. Baste the hem into place being careful that the fold lies exactly along the lower edge of the drawn threads. There are two methods of hemstitching:

Method I.—Hold the wrong side of the hem toward you with the open work space along the first finger of the left hand and work from right to left. Do not use knots, but conceal the end of the thread under the fold of the hem and take two fastening stitches in the fold of the hem. Pass the needle from right to left behind three to six of the threads and pull the thread thru. Now pass the needle behind the same group of threads and thru the extreme edge of the fold of the hem but not thru the material underneath. Draw the thread tight.

Method II.—Hold the material so the bottom of the hem is toward the palm of the hand and work from left to right. Fasten the thread as before. Pointing the needle to the left, pass it under a group of threads and pull the thread thru. This causes the thread to go completely around the group of threads. Take a tiny stitch in the fold of the hem. Draw the thread tight and continue.

14. *Smocking* is composed of stitches taken on the right side of fabrics in an ornamental effect, to hold fulness within a given space. The fabrics best adapted to smocking are sheer lawn, crepes, batiste, voile, soft ginghams, and silks. The thread to use in smocking depends upon the material to be smocked. If silk fabrics are to be used, then the thread should be pure silk and firmly twisted. If cotton, a firmly twisted, fairly large mercerized thread is suitable.

In order that smocking may be very neat, inexperienced workers should carefully mark the material with a series of dots. Transfer patterns may be had for doing this, or they may be made by means of a ruler and sharp-pointed pencil. Dots should be placed ⅛ to ⅜ inches apart according to the weight of the material that is to be smocked, and the fulness desired.

Before beginning the smocking stitch, the material may be gathered with very long stitches underneath and very tiny stitches at the place of the dots; or it may be laid in folds and plaited so that the fulness is held in the right space. Smocking can be done by the experienced worker without first gathering or plaiting the material.

(a) Diamond or Honey-Comb Smocking (Fig. 15, *b*).—Bring needle up thru material at first dot. Let thread drop below the needle, take stitch pointing needle toward left. With thread above the needle take stitch thru next dot at the right and draw material close together. Take a stitch thru second dot in row below with thread above the needle and then thru first dot in second row with thread below the needle, letting thread come out between folds under the

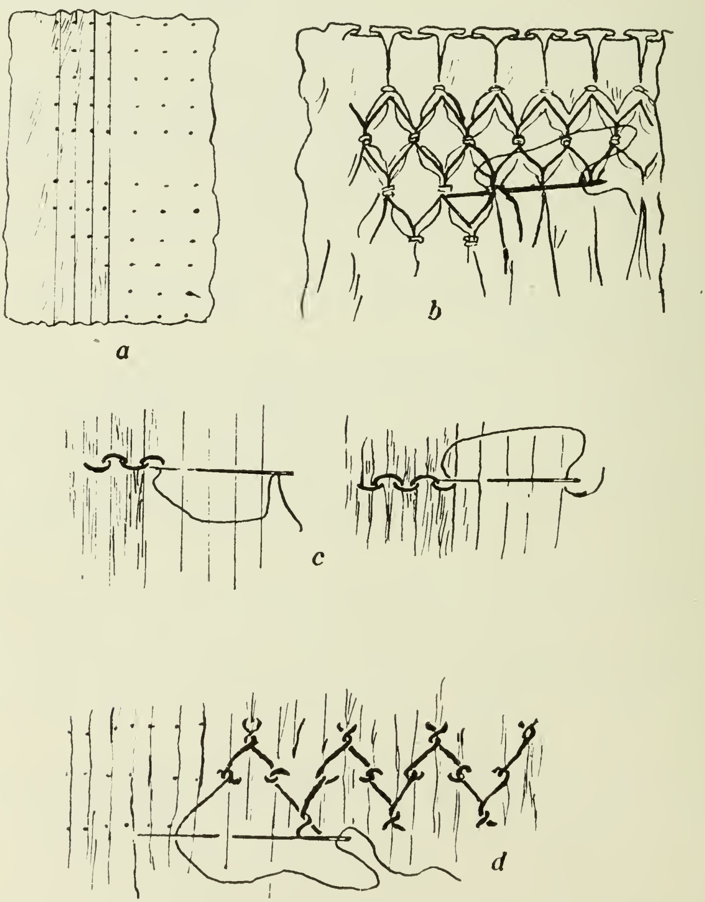

FIG. 15.—Smocking: *a*, Cloth marked for smocking; *b*, diamond or honey-comb; *c*, cable smocking; *d*, zig-zag

stitch and drawing material close together. Continue stitches in same way working up and down.

(b) Cable Smocking Stitch (Fig. 15, *c*).—Work from left to right. Bring needle up thru material at first dot; pointing the needle toward the left, take a stitch thru second dot with thread below needle. Draw thread tightly enough to gather material so that desired fulness will result. Next take a stitch thru third dot as before except that the thread is above the needle.

(c) Zig-zag Smocking (Fig. 15, *d*).—Work from right to left. Bring needle up thru material at first dot, and pointing the needle to the left take a stitch thru first and second dots with thread held under point of needle as in making the blanket stitch. Draw material together. Take a stitch as before thru second and third dots in second row, then thru third and fourth dots in third row and back up thru fourth and fifth dots in second row, etc.

MENDING

Holes, tears, or worn places in garments may be repaired by patching or by darning. Patching is reinforcing holes or worn places with cloth. Darning is reinforcing with threads. Whether a patch or darn is to be used depends upon (a) size of place to be mended, (b) strain, (c) kind of garment to be mended, and (d) material of garment to be mended.

Patches.—There are two types of patches which may be used: (1) hemmed patch, and (2) overhanded patch.

1. The *hemmed patch* is the stronger patch and is always used except for patching an outer garment where the patch will show. To make this patch, cut straight along the first continuous thread on each side of the hole so that as small a square or rectangle as possible results. If the material around the hole is badly worn, however, the worn place had best be cut away. Cut each corner diagonally in about ⅛ inch. Turn each side of the square back once. Place the material which will form the patch underneath the hole, matching the warp and woof and, if figured, the design; baste the folded edge down carefully to the patch and hem or stitch. On the wrong side cut away the part of the patch not needed to reinforce any weak place that was not cut away, turn edge once and hem patch to the garment. Patches are better looking if the distance between the two rows of hemming stitches is not more than half an inch.

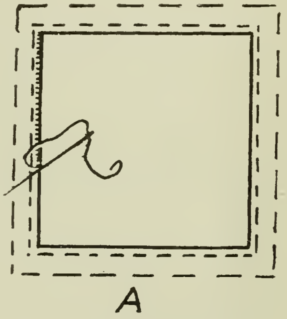

FIG. 16.—Hemmed patch

2. The *overhanded patch* is used a great deal on woolen and silk materials where there is little strain. As in the hemmed patch, the worn part is cut away and the edges turned and basted. The cloth for the patch is carefully matched in pattern and threads, and is creased to fit the hole exactly. Then it is folded back on the material of the garment, and overhanded on all four sides, being careful to strengthen the corners with additional stitches. To prevent raveling, the raw edges on the wrong side are overcasted.

Darns.—Darning is used for mending tears, worn places and holes. The thread used should be as nearly the weight of the material to be darned as possible. Ravelings of silk or wool goods often make the best threads for darning such materials.

A darning ball makes stocking darning easier and if a rather stiff piece of paper is basted under the place on a garment to be darned the work will be facilitated. For darning, small running stitches are used. These are made along both the warp and woof threads carried across the hole and woven in and out in a regular basket weave. When carrying the thread across a hole or tear it is a good plan to place the needle alternately first over then under the edge. When darning knit material, particularly where there is a runner, put the needle thru the loops at the end of the runner or hole. In all darning carry the thread far enough beyond the hole or tear to make a strong darn. If the material is fine or loosely woven do not carry the darning each time to exactly the same thread of the material or the material will pull and a hole result. Figure 18 illustrates a method of avoiding this trouble since when a diagonal darn is made the pull of the darning thread does not come on any one set of threads in the material. When darning on cloth, however, the stitches are taken in the same direction as the threads of the material. When darning stockings or knit material do not pull the thread tight but leave a small loop each time the thread returns.

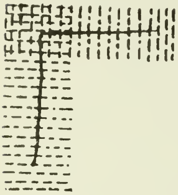
FIG. 17.—The corner tear

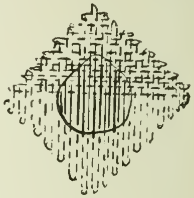
FIG. 18.—Best method of darning a stocking

INDEX

Page
Sewing Tools and Materials 1
Numbers of Thread and Needles for Materials in Hand Sewing 2
Gauges 2
Length of Thread to Use in Sewing 3
Threading a Needle 3
Making a Knot 3
Stitches—Temporary 3
Permanent 4
Constructive Processes other than Stitches 6
Hems, 6; Mitered and cut-out corners, 7; Seams, 7; Bindings, 9; Facings or false hems, 9; Cutting bias, 9; Ruffles, 10; Applying lace and embroidery, 10; Plackets, 10; Bands, 12; Fastenings for garments, 12.
Simple Decorations 15
Self-trimmings, 15; Simple embroidery, 15.
Mending 21
Patches, 21; Darns, 21.

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COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS

University of Missouri College of Agriculture and the United States
Department of Agriculture Cooperating

P. H. Ross, Acting Director Agricultural Extension Service

Distributed in furtherance of the Acts of Congress of May 8, and June 30, 1914

CIRCULAR 90 COLUMBIA, MISSOURI SEPTEMBER, 1920

Garment-Making Club

NUMBER 1

Addie Root

This circular contains directions to club members for making articles and garments simple in construction and design. Directions for doing the hand work required and the principles of sewing involved are presented in Circular 89, Sewing Processes, which should be used to supplement this circular.

Some time should be devoted to the study of materials suggested for making the articles and garments. The names and characteristics of the different goods should be learned in order to be familiar with different kinds of material. The width, price per yard, shrinking, fading, and wearing quality of the material should be considered in order to aid in choosing textiles intelligently.

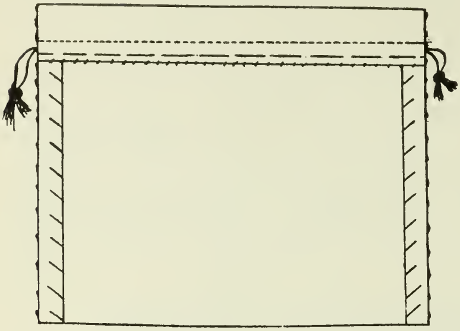
Any material to wear well must have the following qualities: Lengthwise and crosswise threads of about the same weight, and both threads strong enough for the purpose for which the material is to be used. Firm weave. Nothing in the material that can be easily picked off or pulled out. Circular 83, Economical Selection of Textiles and Clothing, discusses these qualities and describes simple tests to determine adulterations.

BAG

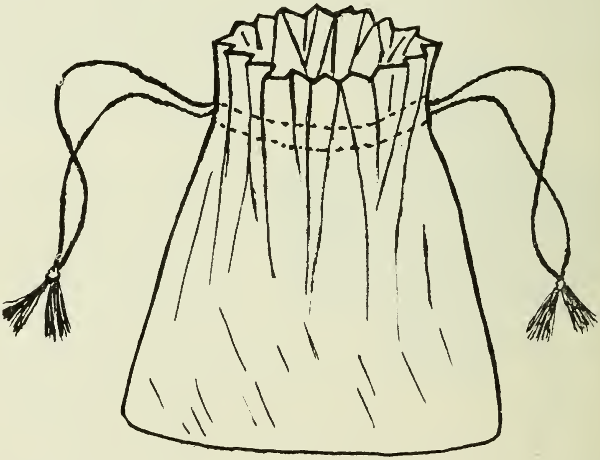
Any type or kind of bag may be made, as a laundry bag, school bag, or sewing bag; the principles involved will be the same.

Material.—Linen, cretonne, chambray, poplin, gingham, crash, denim, or substitute material.

Size.—A good size for a sewing bag is 18 inches wide by 15¼ inches



long when finished. This will take a piece of cloth 18 inches wide and 36 inches long. Desirable sizes for laundry bags are 27 inches wide and 36 inches long when finished, or 18 inches wide by 30 inches long when finished. The laundry bag 27 inches wide will require 2¼ yards of material 27 inches wide. This will allow for a 4-inch hem in top. The laundry bag 18 inches wide will require 1 5-6 yards of material 18 inches wide. This will allow for a 3-inch hem in top, or the material may be 36 inches wide by 33 inches long and this will allow for a 2½ inch hem in top.



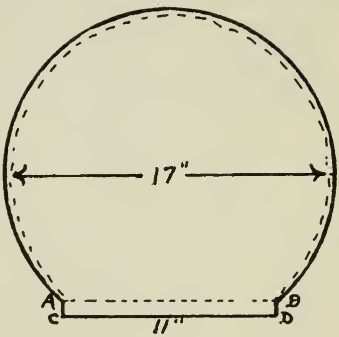
Making bag.—Straighten all edges. Overcast raw edges on sides one-eighth inch deep. Make a one-fourth inch turning on all edges to wrong side of material, and baste. Turn a two and one-half inch hem at each end. Baste and hem, using hemming stitch. Begin with fastening stitch instead of knot and take four or five stitches to make the fastening at both the beginning and the end of all hand stitches used on bag. Beginning at the side of the bag (measuring up from stitched edge of hem one-half inch) make a row of running stitches in hem to form a casing in top of bag for draw string. Place the hems together and fold the material in halves with right sides together. Overhand the sides. Overhand the ends of the hems from the running stitches to the top of the bag. Cut two pieces of tape four inches longer than twice the width of bag. Insert tape in opening on the sides of the bag. Run one tape in from each side. Each tape should come out the same hole it enters casing so that bag can be drawn up at top. Ends of tape may be fastened by tying or sewing in flat felled seam.

CAP

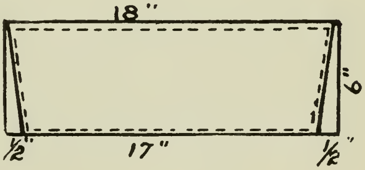
The cap may be made for use as a house or dust cap or it may be made of white material and used for club demonstration work.

Material.—Galatea, Indian head, Linenweave, suiting, or any cotton material with smooth finish.

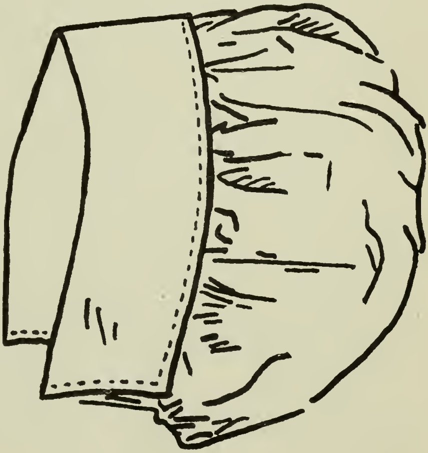
Cutting.—From the illustration it will be seen that the cap consists of two pieces, the crown and the brim. For the crown use a piece of material 18 inches square and draw a circle 18 inches in diameter. Lay a ruler across the circle so the distance measured is 11 inches and mark points A and B. From these points measure down ¾ inch to points C and D. Connect points C and D with a straight line.



For the brim take two pieces of material 6 inches by 18 inches. Measure in from each end on one edge ½ inch as shown in diagram. This will leave one edge 17 inches and the other 18 inches.



Making.—Hem across the straight edge or back of crown turning a half-inch hem. This forms a casing in which to run the tape or elastic. Cut two pieces of tape seven inches long. Fasten at both ends AC and BD and run thru an opening left in the middle of the hem. If this is done the cap can be drawn up to fit the head and let out for laundering. The opening cut in the hem for the tape should be finished with a buttonhole stitch. Divide the rounded portion into halves and gather evenly on a single coarse thread.

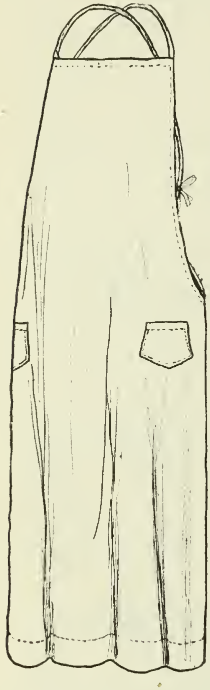


Place the right side of the brim pieces together. Beginning at the end of the two pieces for the brim sew one-fourth inch from the edge around both ends and the narrow side, using the combination stitch. Turn right side out and divide the open side into halves. Place one raw edge of the brim to the gathered edge of the crown and pin in position. Baste, using even basting stitches, holding the gathers toward you. Sew, using the back stitch. Turn the other raw edge of the brim under one-fourth inch and bring it forward just to the stitching of the seam. Baste it down flat. Sew, using the hemming stitch.

APRON

This may be made as a work apron for home use or as a demonstration apron for club work.

Material.—Kind—Indian head, linen finished suiting, firm grade of muslin or any cotton material with smooth finish. Flour or feed sacks, if well bleached, may be used. Amount—Length from base of neck in front to bottom of skirt. This allows for hems. One bolt of one inch cotton tape. One spool white thread No. 70. Narrow bias binding if desired.



Making pattern.—Measure from base of neck in front to bottom of skirt. This measure minus three inches equals AB.

AC—½ width of material.

AD—⅓ of AC.

AO—⅓ of AB.

OH—Drawn parallel with AC.

DE—Drawn parallel with AO.

Connect E and C with straight line.

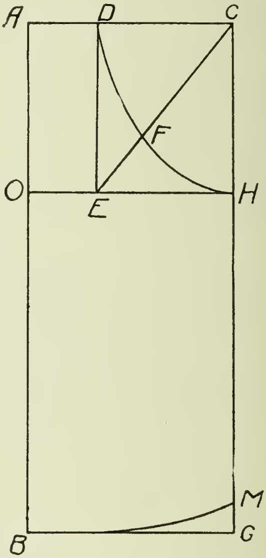
EF—⅓ of EC.

Draw curved line thru F from D to H.

M—2 inches up from G.

Draw curved line connecting B and M.

Cut out pattern AOBMHFD.



Cutting and making the apron: Fold the material lengthwise. Place pattern on material with AB on fold and HM on selvage. Allow two and one-half inches for hem at BM. Allow one-half inch for hem at AD.

The curve DH may be finished by turning in one-half inch hem, or by facing with a bias tape. Turn two and one-half inch hem at BM and one-half inch hem at AD. Baste and sew on machine or by hand, using hemming stitch. Attach tape twelve inches long under hem at H for ties. Also attach tape at corners of bib, point D; these should be long enough to cross in the back and tie to the four-inch piece of tape which should be attached at point F as indicated in pattern.

From the pieces DFHC small square pockets may be cut. Hem across the top and turn one-fourth inch around other three sides. Sew in desired position.

KIMONA NIGHT GOWN

Measurements.—Length of front, measure from highest point of shoulder to the floor.

Bust measure taken loosely.

Desirable width around the bottom, two and one-fourth yards for thirty-six inch bust measure. Figure bottom for other bust measure in the same proposition.

Material.—The amount of cloth needed is twice the length of the front plus twice the width of the hem. Desirable width for hem is two inches.

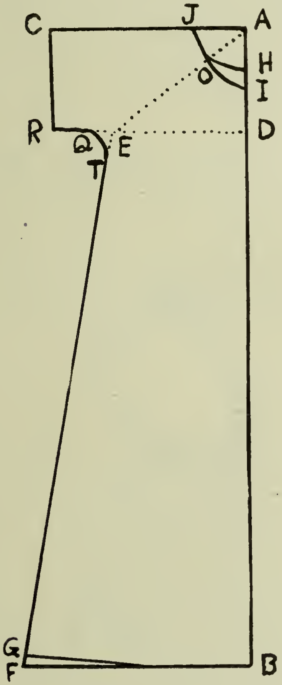
Making pattern.—Draft pattern upon paper according to directions, using diagram as a guide.

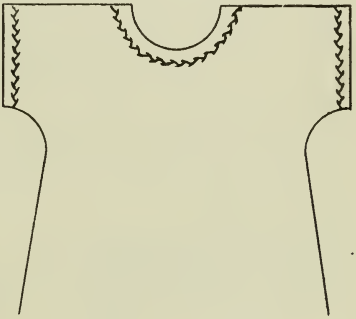
AB—length from neck at shoulder line to floor.

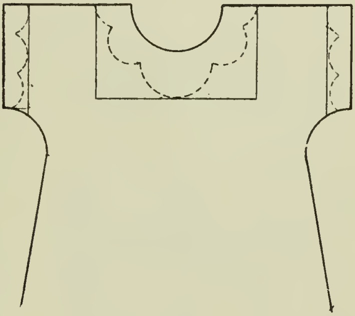
AC—right angle to AB at A, equals one-fourth bust measure plus eight and one-half inches.

AD on AB—one-fourth bust measure.

DR—parallel and equal to AC. Connect C and R.







DE—one-fourth bust measure plus four inches measured on DR from D.

BF—at right angles to AB at B, equals one-fourth desired width, at bottom of gown.

Connect F and E with a straight line.

FG—one-half inch measured on FE.

Connect B and G with curve.

EQ—two inches measured on ER from E.

ET—two inches measured on EG from E.

Connect Q and T with a curve.

AH—one-ninth of bust measure measured on AB from A.

HI—one inch measured down from H on AB.

AJ equals AH measured on AC.

Connect A and E with straight line.

AO equals AH measured on AE from A.

Connect JO and H with curve. This forms line of neck in back.

Cut out pattern following line BDHJCRQTGB. This gives the correct outline.

Making.—Fold the material in half, crosswise. (This will form the line AB in the diagram.) Place the pattern on the goods so that the line AB of the pattern will be on lengthwise fold and line AC will be on crosswise fold.

Cutting.—Cut out carefully, allowing one-half inch for underarm seams.

Make the point I indicated on the pattern on goods in order to cut the neck of gown lower in front than in back, and cut in front from I to J.

If the width of goods does not allow for the desired width at the bottom of the gown take the triangular piece cut from under the arm and apply it at the bottom by overhanding the two selvages together. Sew underarm seams, making French seams.

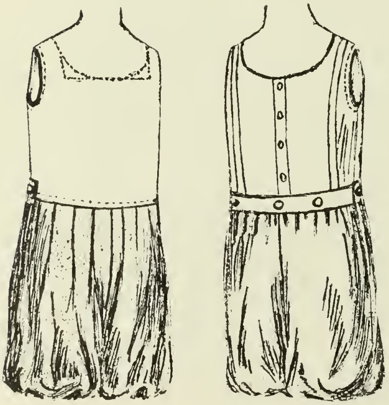
Make two-inch hem in bottom.

Finish neck and sleeves with one-fourth-inch hem or bias tape turned to wrong side and stitched or with shaped pieces finished with fancy stitching as in illustration.

Edge may be trimmed by sewing on a narrow lace edge or by making a simple fancy stitch such as feather stitch, chain stitch, or outline stitch, on right side. If a fancy stitch is used, the bias binding can be fastened down by it and will not need to be stitched.

BLOOMERS

Bloomers are recommended as a very desirable garment for girls of all ages. They may be worn instead of either drawers or petticoats. Bloomers are easily laundered and when used as a petticoat may be made of colored material to match the dress. They are inconspicuous and comfortable.



Material.—Sateen is well adapted for wear under woolen dresses when replacing a petticoat. Bloomers may be made of wash material like the dress or apron with which they are to be worn. These are usually of gingham, chambray, poplin, and other cotton materials.

Pattern.—Purchase a pattern of the proper size and design. Bloomers for general wear are either plaited or circular at the top.

Placing of pattern.—Place the pattern on goods according to directions given on the pattern envelope and cut out carefully.

Making bloomers.—Read directions on pattern envelope carefully for construction of bloomers. Make plackets first. Plain bound plackets are the simplest to make. Finish around bottom of each leg with a plain hem into which elastic is run, or by gathering into a narrow, plain band at the knee, which is fastened to the side with a button, or a buckle and tongue. Bloomers should not be trimmed

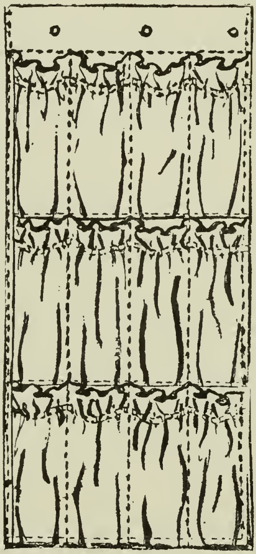
Make flat felled seams one-fourth inch wide. Baste and stitch along upper front and back seams first; match these seams and baste and stitch inside leg seams. Place in band at top, distributing plaits carefully, or place on yoke.

Try bloomers on to see that the length is correct, also that garment fits smoothly at the waist. If too full, take out extra amount in darts.

Place a button on the ends of the front band at each placket and buttonhole with a worked bar at each end of the back band. When bloomers are to be buttoned on an underwaist, buttonholes instead of buttons are placed at center back and front, and on end of bands.

GIFT SUGGESTIONS

When making something for a gift it is well to decide first to whom it is to be given. If a definite need or desire can be supplied the gift is usually more appreciated. The Christmas season is the most interesting time for gift making. The following articles are given as suggestions:



Kitchen holder
Kitchen apron
Dresser scarf
Laundry bag
Slipper bag
Clothespin bag

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CIRCULAR 91 COLUMBIA, MISSOURI OCTOBER, 1920

Cooperative Elevator Association

Articles of Incorporation and By-Laws

Ralph Loomis

The following Articles of Incorporation and By-laws, with modifications to conform to laws of their respective states, are being used by a large number of cooperative elevators in states of the Middle West. The articles of incorporation and by-laws here given are drawn to conform to Missouri statutes now in force.

Questions arising concerning the need for or meaning of particular sections may be addressed to the Agricultural Extension Service, College of Agriculture, Columbia, Mo.

ARTICLES OF INCORPORATION of the ....COOPERATIVE ELEVATOR ASSOCIATION

We, whose names are hereto subscribed, do hereby associate ourselves together for the purpose of becoming incorporated as a cooperative association under the provisions of an act to provide for and authorize the incorporation of agricultural or mercantile cooperative associations (Laws of Missouri, 1919, page 116) and to that end we do adopt and sign the following Articles of Incorporation.

ARTICLE I. Name

The name of this association shall be..
COOPERATIVE ELEVATOR ASSOCIATION.

ARTICLE II. Principal Place of Business

The principal place of business of this association shall be........................
...., Missouri.

ARTICLE III. Object

The purposes of this association shall be to conduct any agricultural or mercantile business on the cooperative plan, including the buying, selling, manufacturing, storage, transportation, or other handling of or dealing in or with agricultural, dairy or similar products, and including the manufacturing transformation of such articles into products derived therefrom; and to purchase of or to sell to all shareholders and others groceries, provisions, and all other articles of merchandise.

ARTICLE IV. CORPORATE PERIOD

The corporate period of this association shall continue for a period of fifty (50) years, with the right of renewal, unless sooner dissolved according to law.

ARTICLE V. ORIGINAL INCORPORATORS

The names and places of residence of the persons forming this association and number of shares owned by each are:

(Names of original incorporators are a part of this article.)

ARTICLE VI. CAPITAL STOCK

The authorized capital stock of this association shall be.. ....thousand dollars ($..) of which not less than one-half shall be subscribed and paid for at the time of commencement of business of this association. The capital stock shall be divided into .... (..) shares of the par value of...dollars ($..) each. No member shall hold more than ten (10) per cent of the capital stock of this association. Shares shall be fully paid for when issued, are non-assessable, and may be transferred as provided in the by-laws.

ARTICLE VII. DIRECTORS

The affairs of this association shall be conducted by a board of seven (7) directors. Until the annual election on the.. of ...., 19........ the following shall be directors of this association:

(Names of first directors are to be given in this article.)

In testimony whereof we have hereunto set our hands this...................................... ....day of ...., 19........

(All original incorporators sign the Articles of Incorporation.)

State of Missouri }
County of ....} ss.

Be it remembered that on this... day of ...., 19........, before me as a notary public within and for said county and state, personally appeared ....

(Names of at least five original incorporators)

to me known to be..of the persons named in and who executed the foregoing articles of incorporation, and each acknowledged that he executed same as his free act and deed for the uses and purposes therein expressd.

....
Notary Public

My commission expires.., 19........

BY-LAWS
of the
..............................COOPERATIVE ELEVATOR ASSOCIATION

ARTICLE I. MEMBERSHIP

Sec. 1. *Qualifications.* Any producer of farm products or any person who may be a user of any of the products or supplies handled by the Association, and a patron or prospective patron thereof in any territory tributary to the shipping points of this Association may, upon application accepted by the Board of Directors, become a member of this Association by agreeing to comply with the requirements of these by-laws and becoming the owner of at least one share of its capital stock. It shall be the policy of this Association constantly to extend its membership among producers as far as possible and not to deny membership to a person interested in production, except under most exceptional circumstances.

Sec. 2. *Terminations.* Whenever a member shall remove from the territory tributary to the shipping points of this Association, the Board of Directors may elect to purchase his shares of stock and to terminate his membership upon tender to him of the book value of his shares as determined from the last preceding financial statement, together with any dividends or refunds due and unpaid, less any indebtedness then due the Association. In all cases of purchasing stock, the Board of Directors shall act only as trustees for the balance of the shareholders. Such stock shall be held in trust by the Board of Directors, pending further disposition to be made by the Board, and shall not be voted while so held.

Sec. 3. *Restrictions.* No member shall own more than.................................. (..) shares of the capital stock of the Association at any one time, unless he shall by operation of law come into possession of additional shares which he may be unable to dispose of as provided in Sec. 4 of Article I of these by-laws. Every member upon uniting with this Association agrees that in case he shall desire to dispose of his shares of stock in the Association the Board of Directors shall have the first right to purchase the same at their book value, and that no offer of assignment of sale shall be made to any person or interest until the Board of Directors decides either to waive this right or to purchase the shares, after thirty (30) days' notice in writing. Any transfer of shares by assignment or sale shall give the assignee or purchaser no other right than to require upon thirty (30) days' notice in writing an election by the Board of Directors either to admit the holder to membership or to tender him the book value of such shares together with any dividends and refunds then due and unpaid.

Sec. 4. *Reversions.* If any member shall by operation of law come into possession of more than... (....................................) shares of the capital stock of this Association the Board of Directors may elect to purchase such excess shares upon tender to him of the book value thereof together with any dividends or refunds due and unpaid. Also in the event of the death or disability of the owner of any shares of stock in this Association, such shares of stock shall revert to the Board of Directors upon the tender of payment by the Board to his heirs or legal representative the book value of same together with any dividends or refunds due and unpaid, or it may elect to transfer such shares to his heirs or legal representative.

ARTICLE II. MEETINGS

Sec. 1. *Annual Meeting.* The annual meeting of the members of this Association shall be held at the principal place of business on the............................ of.. of each year, if not a legal holiday, but if a legal holiday, on the next business day following.

Sec. 2. *Special Meetings.* The President at the request of the Board of Directors shall call a special meeting of the members at any time and must call a special meeting upon the written request of twenty members. No business shall be transacted at special meetings except that mentioned in the notice of said meeting.

Sec. 3. *Notice.* Excepting when a vote is to be taken on amending the Articles of Incorporation, written or printed notice of every regular or special meeting of the members shall be prepared and mailed to the last known post office address of each member, not less than seven (7) days before the date of such meeting, and if for a special meeting, such notice shall state the object or objects thereof, and the time and place of meeting. Notice may also be given by publication in the local newspapers. When a vote is to be taken on amending the Articles of Incorporation, at least sixty (60) days' notice shall be given by letter addressed to each shareholder at his last known address, and a notice shall be published at least once a week in a newspaper published in .... County, Missouri, the first insertion being at least sixty (60) days before the day on which the meeting is to be held, and the last insertion not less than one (1) nor more than five (5) days previous to the day on which the meeting is to be held.

Sec. 4. *Voting.* Excepting in the electing of directors, each member shall be entitled to but one vote, irrespective of the number of shares owned, which vote may be cast by proxy. In the election of directors of this Association, each member shall have the right to cast as many votes in the aggregate as shall equal the number of shares held by him or her in the Association multiplied by the number of directors to be elected in the election; and each member may cast the whole number of votes, either in person or by proxy, for one (1) candidate, or distribute such votes among two (2) or more candidates. At any regularly called general or special meeting of members for the purpose of electing directors, a written vote signed by, and received by mail or messenger from, any absent member, shall be accepted as the vote of such absentee. This rule shall apply also to any such written vote of any absentee at any regularly called general or special meeting of members for the purpose of determining the business policies of the Association.

Sec. 5. *Quorum.* One-fifth of the members shall constitute a quorum for the transaction of business at any regular or special meeting, excepting when the removal of a director is under consideration when a majority of the members shall be present. A majority of all vots cast shall carry on all questions of adoptions except amendments to the Articles of Incorporation and By-laws and removal of directors, which shall require a two-thirds vote of the members present.

Sec. 6. *Order of Business.* In all meetings of this Association the business shall be transacted in the order prescribed and in accordance with these rules of order:

1. Calling of roll.
2. Proof of due notice of meeting.
3. Reading and disposal of unapproved minutes.
4. Report of the President.
5. Report of the Secretary.
6. Other reports.
7. Unfinished business.
8. New business.
9. Election of directors.
10. Miscellaneous work.
11. Adjournment.

All decisions, rulings and actions on questions in any meeting of this Association for which there are no provisions made in the by-laws or rules of order of this Association shall be made in accordance with Robert's Rules of Order.

ARTICLE III. CAPITAL STOCK

Sec. 1. *Treasury Stock.* The treasury stock of this Association shall consist of such issued and outstanding stock of the Association as may be donated to it and shall be held subject to disposal by the Board of Directors.

Sec. 2. *Stock Certificates.* Certificates of stock shall be issued to each holder of full-paid stock. Each certificate shall state the par value of the stock, the number of shares represented, the name of the person to whom issued and shall bear the signatures of the President and Secretary and the seal of the Association and be numbered and issued in numerical order from the stock certificate book. Each certificate shall bear the following statement:

"This certificate is issued and accepted in accordance with and subject to the conditions and restrictions stipulated in the by-laws and amendments to the by-laws of the .... Cooperative Elevator Association, and more specifically in Section 1, 2, 3 and 4 of Article I, and Section 1, 2, 3, 4 and 5 of Article III, which are printed on the back of this certificate and made a part of the signed agreement and receipt which are on the stub record bearing the same number and date as this certificate."

Sec. 3. *Stock Receipts.* A record of each certificate of stock issued shall be kept on the stub thereof and each certificate issued shall be receipted for on the stub in the following form:

"In consideration of the issuance to me of this certificate of stock No. .... for .... (......................) shares of the capital stock of the .... Cooper tive Elevator Association, I do hereby agree to all of the conditions of membership, stock ownership, and stock transfer stipulated in Sections 1, 2, 3 and 4 of Article I and Sections 1, 2, 3, 4 and 5 of Article III of the By-laws, which are set forth in full on the certificate and made a part of this agreement. I have received the said certificates of stock this..day of... 19.........

....

Signature of Member.

....

Witness

Sec. 4. *Transfers.* Transfers of stock shall be made only upon the books of the Association, either in person or by power of attorney, duly appointed and constituted, upon surrendering the certificate of stock for cancellation, and no transfer shall be valid unless same has been duly entered on the books of the Association. When this has been done a new certificate of stock shall be issued to the person acquiring the stock. No stock shall be transferred while the owner or holder thereof is in arrears to the Association. The stock books of the Association shall be closed for transfer ten (10) days before the annual meeting and ten (10) days before the time set for payment of interest and patronage refunds.

Sec. 5. *Lost Certificates.* The Board of Directors may order new certificates of stock to be issued in the place of any certificates alleged to have been lost or destroyed but the owner of the lost crtificates shall first cause to be given to the Association a bond in such sum, not less than the par value of such lost or destroyed certificate, as said Board may direct, as indemnity against any loss or claim that the Association may incur by reason of such issuance of stock certificates, or in the discretion of the Board of Directors, a new certificate may be issued upon filing with the secretary an affidavit properly certifying to the loss of the original certificates.

ARTICLE IV. DIRECTORS AND OFFICERS

Sec. 1. *Directors.* The business of this Association shall be conducted by a board of seven directors. The members of the first Board of Directors shall hold office until the first annual meeting when their successors shall be elected from the membership of the Association for terms of office as follows: three for one year, two for two years, and two for three years. Upon the expiration of the terms of the directors so elected, their successors shall be elected for terms of three years. Directors shall hold office until their successors shall have been elected and have qualified and entered upon the discharge of their duties.

Sec. 2. *Election of Officers.* The Board of Directors shall meet within ten (10) days after each annual election, and shall elect by ballot from among themselves a President, Vice-President, Secretary, and a Treasurer (or a Secretary-Treasurer). Such officers, unless sooner removed, shall hold office for one year or until their successors are elected and qualified.

Sec. 3. *Vacancies.* All vacancies in the membership of the Board of Directors shall be filled by the members in a meeting duly held. When any director has been removed for cause by the members, such action shall vacate any office held by him and such vacancy shall be filled from among the Board of Directors so constituted after the vacancy in the Board has been filled by the members.

Sec. 4. *Quorum.* A majority of the Board of Directors shall constitute a quorum at any meeting of the Board of Directors.

Sec. 5. *Removal.* Any director of the Association may, for cause, at any annual or at any special meeting called for the purpose, at which a majority of the members shall be present, be removed from office by vote of not less than two-thirds of the members present. Each director shall be informed in writing of the charges preferred against him at least ten (10) days before such meeting, and at such meeting shall have an opportunity to be heard in person, or by counsel, and by witnesses in answer thereto. Officers or agents of the Board of Directors may be removed from office or employment at any time by action of the Board of Directors.

Sec. 6. *Compensation.* The compensation of the officers and other directors shall be determined by the members of the Association at any annual or special meeting.

ARTICLE V. DUTIES OF DIRECTORS

Sec. 1. *Management of Business.* The Board of Directors shall have general supervision and control of the business and affairs of the Association and shall make all necessary rules and regulations, not inconsistent with law or the Articles of Incorporation and By-laws, for the management of the business and the guidance of the officers, employees, and agents of the Association. The Board shall have installed an accounting system which shall be adequate to the requirements of the business, and it shall be the Board's duty to require proper records to be kept of all business transactions.

Sec. 2. *Employment of Manager.* The Board of Directors shall have power to employ and to dismiss a business manager, and to fix his compensation.

Sec. 3. *Bonds.* The Board of Directors shall require the Manager and all other officers, agents and employees charged by the Association with responsibility for the custody of any of its funds or property to give bond for the same. Such bonds shall be furnished by a responsible bonding company approved by the Board of Directors and the cost thereof shall be paid by the Association.

Sec. 4. *Meetings.* The Board of Directors shall hold regular bi-monthly metings, at such time as the Board may agree on, at the Association's principal place of business. Special meetings of the Board shall be held upon call of the President at his discretion or when petitioned by three (3) members of the Board.

Sec. 5. *Inventory and Audit.* The Board of Directors shall take, or cause to be taken, at least once each year an inventory of all property and merchandise belonging or owing to and by the Association. At least once in each year the Board of Directors shall secure the services of a competent and disinterested auditor or accountant who shall make a careful audit of the books and accounts of the Association and render a report in writing thereon, which report shall be submitted to the members of the Association at their annual meeting.

Sec. 6. *Depreciation.* Annually the Board of Directors shall cause to be charged as part of the operating expense of the Association a reasonable allowance for depreciation upon the original value of all buildings, office fixtures and equipment.

Sec. 7. *Educational work.* The Board of Directors is authorized to conduct educational work for the purpose of stimulating interest in co-operative activity; to subscribe for and have sent to the members such cooperative literature and publications as they may determine upon, and to obtain membership for this Association in any state association or other organization of co-operative associations which may tend to further the objects and purposes of this Association.

ARTICLE VI. DUTIES OF OFFICERS

Sec. 1. *President.* The President shall preside over all meetings of the Association and of the Board of Directors, sign as President with the Secretary, or Secretary-Treasurer, all stock certificates, notes, deeds, contracts, conveyances, agreements, and other instruments requiring such signatures, call special meetings of the Association and of the Board of Directors and perform all acts and duties usually required of an executive and presiding officer.

Sec. 2. *Secretary.* The Secretary shall keep a complete record of all meetings of the Association and of the Board of Directors, sign as Secretary, with the President, all stock certificates, notes, deeds, contracts, conveyances, agreements, and other instruments requiring such signatures; serve all notices required by law and these By-laws; keep a complete record of all business of the Association and make a full report of all matters and business pertaining to his office to the members at the annual meeting; make all reports required by law; and perform such other duties as may be required of him by the Association or the Board of Directors.

Sec. 4. *Treasurer.* The Treasurer shall receive, have the custody of and disburse such moneys, notes and securities as may come into his possession by virtue of his office or by direction of the officers of the Association. He shall pay out the moneys so received as ordered by the Board of Directors. He shall keep or cause to be kept a full and complete record of all receipts and disbursements.

ARTICLE VII. DUTIES OF MANAGER

Sec. 1. *In General.* Under the direction of the Board of Directors the Manager shall have general charge of the ordinary and usual business operations of the Association, including the purchasing, marketing, and distributing of all products and supplies. He shall conduct the business on a margin above cost basis, endeavoring to maintain a margin which will be uniform and just on each kind or grade of grain, products and supplies handled. He shall deposit in a bank all moneys coming into his possession, making disbursements therefrom by check.

Sec. 2. *Duty to Account.* He shall be required to maintain his records and accounts in such manner as will at all times show the true and correct condition of the business. He shall render annual and periodical statements in the form and manner prescribed by the Board of Directors. He shall carefully preserve all books, documents, correspondence ,and records of whatever kind pertaining to the business which may come into his possession. He shall prepare daily and file in the Association's office a grain statement which shall show the total amount of each kind of grain in the elevator, in transit unsold, contracted from farmers and undelivered, together with the total amount in store, and due on open sales as well as the amount represented by purchases or sales of futures, all of which shall be arranged to show the net amount of grain long or short at the close of business each day.

Sec. 3. *Duty to Insure.* He shall be required at all times to keep the property of the Association well and fully insured, which insurance must extend to and cover grain and property of all kinds, regardless of ownership, which may be in possession of the Association or stored by it.

Sec. 4. *Control of Help.* He shall have control over and may employ and dismiss all agents and employees of the Association not specially employed by the Board of Directors.

ARTICLE VIII. Earnings

Sec. 1. *Apportioned.* At the annual meeting or at a special meeting of members, the total net earnings of the Association which remain over and above all expenses and a reserve for depreciation, shall be apportioned in the following manner:

(a) Reserve. There shall be apportioned for the purpose of creating a reserve not less than ten (10) per cent of the net earnings until such reserve shall equal at least fifty (50) per cent of the capital stock paid.

(b) Dividend on Capital Stock. There shall be appropriated for the purpose of providing a dividend on capital stock a sum which will provide a dividend on stock issued and outstanding not to exceed the current rate of interest being paid by borrowers at local banks, and in no case to exceed the contract legal interest rate for the state of Missouri.

(c) Educational. There may be appropriated for educational purposes and for promoting co-operation and improvement in agriculture a sum equal to (5) per cent of the net earnings.

(d) Patronage Refund. The remainder of the net earnings shall be apportioned upon patronage in accordance with the method stipulated in Section 2.

Sec. 2. *Method of Refund.* The earnings upon grain operations, the earnings upon miscellaneous products, and the earnings upon supplies and merchandise operations shall be segregated into groups (a), (b), and (c) respectively. Additional groups shall be established only as are necessary to provide for various commodities handled on widely varying net margins. Special transactions handled on the basis of actual cost of service shall be excluded in computing patronage refunds hereunder. Patronage refunds shall not be paid to commission firms, dealers and manufacturers on wholesale business transacted with this Association.

(a) Grain Rate. The total net earnings which accrue from grain operations after deducting an equitable proportion of all expenses and the appropriations provided for in Section 1 shall be divided by the total number of bushels of grain of all kinds bought from patrons by the Association during the year. The result shall be the patronage refund rate per bushel to be applied to grain purchased from members.

(b) Miscellaneous Products Rate. Patronage refund rates for other products bought by the Association shall be determined in the same manner as provided for grain except that they may for convenience be determined upon the basis of money value, instead of per unit, at the discretion of the Board of Directors.

(c) Merchandise Rate. The total net merchandise earnings which accrue from merchandise and supplies operations after deducting an equitable proportion of all expenses and the appropriations provided for in Section 1 shall be divided by the total volume in dollars of the merchandise sales during the year. The result shall be the patronage refund rate in percent to be applied to merchandise sales.

Sec. 3. *Member's Share.* Each member shall receive patronage refunds based upon the total volume of grain and other products sold to the Association and the volume of supplies and merchandise of all kinds bought from the Association during the year which shall be computed by applying the refund rates as determined under divisions (a), (b), and (c) of Section 2 hereof.

Sec. 4. *Non-member's Share.* Each non-member may receive patronage refunds under the provisions of this Article at one-half the rate which is paid to members, provided that refunds appearing to his credit shall first be applied to the purchase for him of one share of the capital stock of this Association.

Ses. 5. *Disposal of Unapportioned Share and Non-members' Unapplied Refund.* Earnings on the business of non-members not paid to them as patronage refund, and patronage refund payable to non-members which is not accepted under the provisions of Section 4 hereof, shall be placed in the Association's surplus fund.

Sec. 6. *Notice of Refund due Non-members.* At least once each year there shall be mailed to each non-member entitled to refund a notice which shall state the amount of refund due, the conditions under which the refund will be made and which shall contain a suitable form of application for membership.

Sec. 7. *Capital Impairment.* In no event shall dividends on capital stock as provided for in division (b) of Section 1, hereof, be paid out of the capital stock, but in case the earnings of the Association in any year shall be insufficient for this purpose a sum equal to such deficiency may be set aside from the earnings of the following year before any portion of these earnings is made available for patronage refunds.

ARTICLE IX. SUNDRY PROVISIONS

Sec. 1. *Fiscal Year.* The fiscal year of this Association shall commence on the first day of February and end on the last day of the following January.

Sec. 2. *Extension of Credit.* The business of this Association shall so far as possible be conducted on a cash basis. All accounts due and unpaid at the end of thirty (30) days shall bear interest at the rate of eight (8) percent from the date of sale, and all sales tickets or bills of sales shall so state.

Sec. 3. *Collective Buying.* All merchandise purchased through the Association, other than that regularly carried in stock shall be paid for in cash by the members ordering such supplies at time of ordering same, or the money may be deposited with a bank which has been approved by the Board of Directors, at the time of ordering.

Sec. 4. *Protection of Grain Purchases.* Neither the manager nor any other agent or employee of this Association shall during the period of his term of office or employment be permitted to deal or trade in futures or options in grain or other commodities or stocks in his own name or in the name of any other person or in the name of this Association except as it may be necessary to hedge actual purchases or holdings of grain or sales of stored grain and then only with the knowledge and consent of the Board of Directors. This Association shall so far as it is practicable avoid any and all speculation in grain, and shall not at any one time accumulate by purchase or contract an amount which in the aggregate shall exceed.. thousand (...) bushels unless the same shall be resold or properly protected by sales of futures.

Sec. 5. *Corporate Seal.* The corporate seal of this Association shall consist of two concentric circles, between which shall be the name of this Association, and in the center of which shall be inscribed: Incorporated, 19........, Missouri. Such seal is adopted as the corporate seal of the Association.

Sec. 6. *Emergency Capital.* At the time of uniting with this Association or at any time thereafter, when called upon by the Board of Directors, each member shall deliver to the Association his negotiable promissory note, payable on demand, to the order of the Association. Such note shall be for the sum of twenty-five dollars ($25.00) plus ....dollars, ($.................................) for each acre of crops to be grown by the members whose products are to be marketed through the Association. These notes shall be the property of the Association for the purpose of being pledged by the Board of Directors as collateral security for any loan that may be necessary in the conduct of the business of the Association. Any member's note shall be available in the settlement of any damage to the Association that may result from the failure of said member to make good his contracts.

Sec. 7. *Amendments.* These By-laws may be amended or repealed, so far as is consistent with the Articles of Incorporation and Missouri statutes, by a two-thirds vote of the members present at any annual or regularly called but no change shall be made at any special meeting unless notice of the proposed change shall have been given in the call for said meeting.

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COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE AND THE UNITED STATES
DEPARTMENT OF AGRICULTURE COOPERATING
P. H. Ross, Acting Director Agricultural Extension Service

Distributed in furtherance of the Acts of Congress of May 8, and June 30, 1914

CIRCULAR 92 COLUMBIA, MISSOURI OCTOBER, 1920

Cooperative Spraying Demonstrations
in
Missouri Apple Orchards 1916-1918

T. J. Talbert

During the season 1913 the University of Missouri began spraying demonstration work in a few of the principal apple producing counties of the state. This work was continued in 1914 and a full report of it is given in Missouri Agricultural Experiment Station Bulletin 124, "Profits From Spraying Twenty-five Missouri Orchards in 1914." Since 1914 the work has

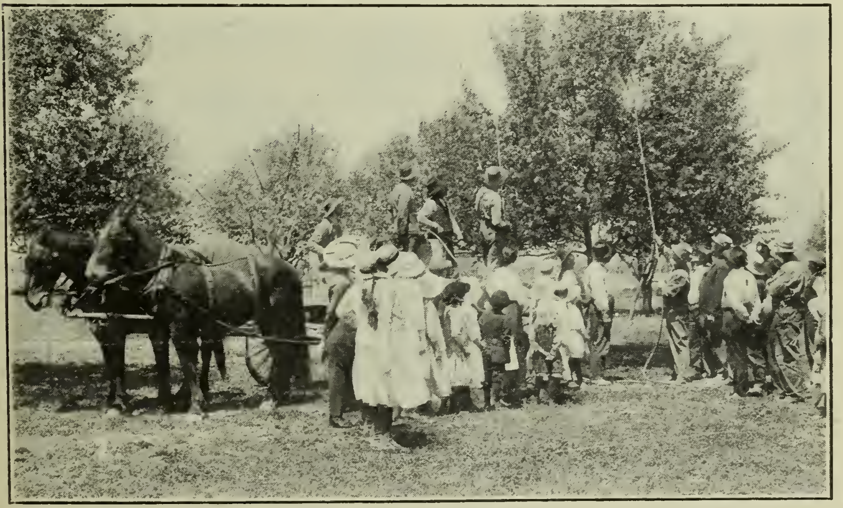

FIG. 1.—Making a spraying demonstration with a barrel-pump outfit; farmers and pupils from the country school observing the work

been carried forward by the Agricultural Extension Service of the University of Missouri, College of Agriculture.

The present report includes only the orchard demonstration work of which the writer had charge, and extends from 1916 to 1918, inclusive.

PURPOSE OF SPRAYING DEMONSTRATIONS

The purpose of the spraying demonstrations was to prove beyond a reasonable doubt the practicability of spraying apple trees and the fact that clean, marketable apples may be grown successfully and profitably by applying thoro and timely sprays made from the proper materials. In the beginning, the work was difficult as cooperators in some counties were not easily obtained. It was like reviving a lost industry in which those formerly interested had become discouraged and had decided the whole undertaking a failure.

Many of the apple growers had concluded that the fine, well-developed apples which their fathers and grandfathers once raised could not longer be grown. Some attributed the failure of fruit in the orchards to a change in climate; others to the changes in soil fertility, and still others to the nurserymen who they asserted do not sell the healthy, long-lived, vigorous trees which were propagated in the earlier days. The fault was also said to be due to the fact that most orchardists now plant the piece-root instead of the whole-root tree. A few maintained that sprays were injurious to apple orchards, declaring that it made the trees unprofitable and caused them to die early.

Our task was to overcome these false ideas by establishing spraying-demonstration orchards where the farmer would have an opportunity to observe the work from beginning to end. The demonstration method of teaching in each community was believed to be the most practical, convincing and helpful of any that could be employed. The old maxim, "seeing is believing," is perhaps of as much value today as in earlier times.

PLAN OF WORK

In all cases the demonstrations were made in cooperation with orchard owners. The orchardist provided the labor, spraying equipment and spraying materials needed. He also kept a careful and accurate account of the cost of labor and materials used in the orchard. In practically all the demonstration orchards a few trees were left unsprayed for the purpose of noting the difference in results between sprayed and unsprayed trees.

The Agricultural Extension Service of the College of Agriculture, thru its orchard specialists, had complete charge of the work, which included directions when to spray, what materials to use and the manner of making the applications. Where the orchardists were interested sufficiently to take up other work such as pruning, cultivating, and fertilizing, they were urged to do so. When such work was undertaken it was done under the supervision of the specialist from the College.

Since it was known that results sufficiently striking to interest any orchard owner could be obtained in almost any neglected apple orchard worth giving attention, a special effort was made during the first season to apply the required sprays thoroly and timely. Where this was done the results were so much better in every case than the owner had expected that there was no difficulty experienced the next year in getting him to take up almost any line of work intended for the improvement of the orchard.

In counties having county agricultural agents, material assistance was rendered by the agents. Practically all the arrangements as to the selection of demonstration orchards, advertising the meetings, securing spraying equipment and spraying chemicals, etc. were made by them. The county agents also gave great aid by moulding public opinion favorably toward the work, keeping interest alive by holding farmers' meetings and by publishing timely articles in the local newspapers.

Tables 1, 2, 3, and 4 which follow give the name, postoffice and county of each orchard owner. The number of sprays applied, the cost of material and labor as well as the profits obtained from each, are also given. The counties are fairly representative and should give any orchard owner an idea of what may be expected from careful and timely spraying.

RESULTS FROM COOPERATIVE DEMONSTRATION ORCHARDS IN 1916

These figures show what can be accomplished by spraying. No cultivating, pruning or fertilizing was done in any of the orchards during this year.

Table I.—Results in 1916

Orchard owners	No. of trees	Age of trees, years	Number of sprays	Cost of material and labor	Profits from spraying
Butler County					
P. G. Haag, Poplar Bluff......	100	20	2	$97.50	$71.25
Cape Girardeau County					
H. Burhl, Oak Ridge...............	25	15-30	3	$ 8.55	$31.45
R. Tuschhoff, Oak Ridge........	20	25	3	12.25	16.17
Carroll County					
R. W. Craig, Carrollton	140	16	3&4	$ 34.75	$ 310.15
J. B. Bargold, Wakenda	400	25	4	159.80	1560.20
Clara H. Heins, Carrollton	750	24	3&4	300.00	400.00
Chas. Winfrey, De Witt........	3300	15	3	1299.45	3200.00
Jefferson County					
T. B. Hentcher, De Soto	20	24	3	$16.25	$63.75
Nodaway County					
Bert McKee, Ravenwood......	15	20	3	$8.25	$16.75
St. Charles County					
Mrs. Burns, St. Charles	47	25	4	$25.65	$90.35
Wm. Sehrt, Augusta	65	20	3&4	23.78	52.47
St. Louis County					
Geo. Weinreich, Jefferson Barracks	33	28	4	$21.35	$265.70
Sullivan County					
T. H. Dewitt, Green City......	50	20	4	$8.52	$101.48
Porter Bros., Green City......	12	18-20	2	1.55	18.45
A. L. Miller, Green City........	35	20	3	3.43	56.57
Mrs. R. D. Clelland, Green City	45	12-15	2	2.50	27.50
Sam Yoss, Green City............	30	20	4	8.52	31.48

PREVIOUS CONDITION AND DESCRIPTION OF DEMONSTRATION ORCHARDS, 1916

Bargold orchard.—The Bargold orchard was about 25 years old and had never been sprayed until the season of 1916. A power spraying outfit was used. The principal varieties were Ben Davis and Gano. The 600 trees had never yielded more than $350 worth of fruit any one year, and complete failures had been common. The owner had decided that the orchard was a failure and unless more could be accomplished by spraying than had been produced by his neighbors who sprayed their orchards, it was not advisable to spray. The 400 sprayed apple trees produced a net profit of $1,560.20 as a result of spraying while the 200 unsprayed trees of the same age and variety and on the same farm with equally as heavy bloom in the spring did not produce a dollar's worth of fruit at harvest time.

Winfrey orchard.—This young orchard was healthy and thrifty and received fairly good care from the beginning. Only a few trees were pruned, however, and no cultivation was given. The trees were slightly infested by San Jose scale. The average price received for the fruit from about 60 acres had been for the past two seasons about $4,000 annually. The set of fruit was very poor this year on many blocks of trees. The spraying work was very well done, however, and on July 1 it was difficult to find an apple in the entire orchard that showed the least sign of insect injury or disease. Proper spraying this year with fewer apples increased the value of the fruit to $4,500, making a net profit of $3,200. The varieties were Winesap, Jonathan and Ben Davis. A power spraying outfit was used in spraying the orchard. The fruit from 200 unsprayed trees on the same farm was worthless and was not marketed.

Weinreich orchard.—This orchard had been regularly sprayed for three years but San Jose scale was not being controlled and the fruit harvested was low in quality and of a poor grade. The outfit used was a power sprayer. Many orchards in the same neighborhood having better trees and a larger number did not yield more than one-third as much fruit as this orchard and the fruit was not so clean. The fruit from the unsprayed or check trees was worthless.

As to the fruit produced in the Weinreich orchard we wish to quote a letter from the Krueger-Thompson Fruit and Produce Commission Merchants, St. Louis, Mo.:

"In regard to Mr. Geo. Weinreich's apples this year, they were the cleanest and healthiest, and had fewer stings, worms and cripples than any of the Missouri apples we handled. In cleanness they compared favorably with the apples from Calhoun County, Illinois, where some of the cleanest fruit in the country is produced."

Burns orchard.—This orchard had been almost ruined by San Jose scale. Perhaps one-third of the trees had been killed and all the others had been greatly weakened. The dormant spray for scale was applied with a barrel pump outfit in the spring of 1916, just before growth started in the fruit buds. For the past five years the fruit from this orchard had been practically worthless.

In regard to the condition of the trees after spraying, Mrs. Burns' report states: "About 20 of the trees were in very bad condition, damaged by scale, by storm and with a considerable percentage of dead limbs. The condition of the orchard at present is fine, but the damaged trees need pruning and it will be necessary to spray again this winter for scale." The trees were 25 years old.

Craig orchard.—A power sprayer was used. The varieties were mainly Ben Davis and Gano. The orchard had been sprayed for two or three years but yielded only about $75 worth of fruit annually. The set of fruit in 1916 was comparatively light and the increased yield to $310.15 worth of fruit was due entirely to more thoro and timely spraying. The fruit from four check or unsprayed trees was valued at $1.50.

Sehrt orchard.—The Sehrt orchard was badly infested by San Jose scale. Many of the trees had been killed and nearly all of them had dead limbs in their centers and tops which had been killed by the scale. The sprays were applied with a barrel pump outfit. The orchard was never sprayed before and the value of the fruit in previous years was practically nothing. The owner was almost ready to cut the orchard down and make it into firewood. The fruit from the unsprayed or check trees was unfit for home use or the market. The varieties were Winesap and Ben Davis.

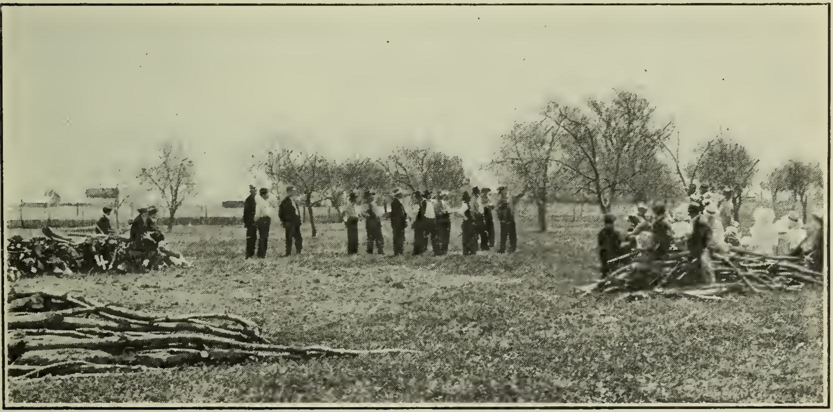

Fig. 2.—Burgeschulte orchard, Portage de Sioux, St. Charles County, was being cut down for fire wood because it was badly infested by San Jose scale, and the owner believed the pest could not be controlled. The remainder of the orchard was sprayed and made profitable

McKee orchard.—A home orchard consisting of several varieties of apples about 20 years old. The orchard had been poorly sprayed for two or three years and the results were not satisfactory. The barrel-pump outfit used was old and worn and it was with greatest difficulty that effective work was done.

Truschhoff orchard.—The trees had been neglected and were heavily infested by San Jose scale. No fruit of any consequence had been produced for several years. The orchard had never been sprayed before. No fruit was harvested from the four check or unsprayed trees. A barrel-pump outfit was used in applying the sprays.

Burhl orchard.—This old orchard had been unprofitable for many years and the trees had been dying out every year until only one-tenth of the original number remained. From one-third to one-half the limbs of many of the trees were encrusted with San Jose scale. Many branches had been killed by the scale and others were badly affected by Illinois blister canker. The spraying was the only work done in the orchard. The trees had never been sprayed before and the orchard had been pastured with live stock for many years. The value of the fruit from 12 unsprayed trees left as checks upon the spraying work in the same orchard was nothing. A barrel-pump outfit was used in applying the sprays.

Sullivan County orchards.—The demonstration work in Sullivan County was all done in home orchards which had been neglected and were unprofitable. In many cases a crop of fruit had not been produced for several years. It was the general opinion of many farmers in this county that it was impossible to produce good fruit. Some maintained that the soil was not adapted to fruit growing and that the climate had changed, and the new conditions made fruit production impossible. The check or unsprayed trees left in each demonstration orchard produced no fruit and all the unsprayed orchards of the county failed to produce fruit of a marketable quality.

The success of the orchard spraying demonstration work in 1916 was due almost entirely to spraying. Very little pruning, cultivating or fertilizing was practiced in any of the orchards listed.

PROFITS OBTAINED FROM SPRAYING HOME ORCHARDS

In order to demonstrate the money value of the fruit which may be produced from the home orchards of Missouri the Agricultural Extension Service began in 1917 a series of spraying demonstrations in home orchards.

The counties in which these spraying demonstrations were held were distributed widely enough to represent in general the conditions in every county of the state. The results obtained should convince every Missouri farmer that it will pay to spray and care for the apple orchard even if it consists of only a few trees.

Table 2 shows the results from spraying ten home orchards in ten different counties in Missouri. These ten orchards total 11.16 acres, averaging a little more than one acre for each orchard. At the close of the season, after the farmers had picked and measured their fruit and deducted the cost of labor and materials, their reports show that the fruit produced averaged $284.91 an acre, counting 50 trees to the acre. The profits obtained were due entirely to spraying as the orchards were not pruned, cultivated or fertilized. They had not been profitable in the past and received their first sprayings during this demonstration.

RESULTS FROM SPRAYING TEN HOME ORCHARDS IN TEN MISSOURI COUNTIES, 1917

Home orchards which had been unprofitable and were never sprayed until season of 1917.

TABLE 2.—RESULTS IN 1917

County Name Post Office	Number of trees	Age of trees	No. of fruit sprays	Cost of material and labor	Profits from spraying
Adair County Emmet Linder, Kirksville......	7	20	5	$ 3.82	$ 43.18
Barry County Joe Baker, Cassville................	20	10-20	2	11.50	248.75
Butler County W. S. Melton, Poplar Bluff....	24	11	2	15.00	55.00
Cape Girardeau County G. C. Kinder, Daisy................	8	13	4	6.00	54.00
Clinton County Clyde Shelman, Cameron	18	15	3	8.92	116.08
Knox County W. E. Cottey, Edina	300	20	3	60.00	440.00
Madison County J. C. Beard, Fredericktown....	10	15	3	5.50	24.50
St. Charles County Louis Hackman, St. Charles	21	15-18	3	16.71	239.41
St. Francois County C. J. Westmire, Farmington	20	17	3	15.32	145.18
St. Louis County Chas. Tanzberger, Jefferson Barracks	130	17	2	84.00	1813.55

REPORT FROM THE HOME ORCHARD COOPERATORS

The following excerpts from the reports of the orchard owners are indicative of the value of spraying:

Emmett Linder, Kirksville: "We consider our spraying a success. Apples are of fine quality and absolutely free from worms."

Joe Baker, Cassville: "Yes, we think it pays to spray. It is the only way to raise marketable fruit."

Clyde Shelman, Cameron: "Quality of fruit somewhat impaired by hailstorm during early summer. All fruit free from worms and blotch. Average yield before spraying $25. Profits from spraying this year $116."

J. C. Beard, Fredericktown: "A very light apple crop for this county. My first spraying. Expect to keep it up."

Charles Tanzberger, Jefferson Barracks: "I sprayed a good many trees for scale that did not have any fruit buds at all. My apples were divided into first and second grades. Out of my 500 barrels of Winesap apples I had about 80 barrels of seconds. The culls which I kept myself made about three barrels of cider. I sold the apples (500 bbls.) to one man alone. He paid me one price all the way thru, which was $3 a barrel. All that I had to do was to pick the apples. The commission man barreled them and stood the barrels and hauled them away from the place also. In 1916, without spraying, the same orchard produced 3 barrels of vinegar. Since spraying, $1,813.55."

SPRAYING DEMONSTRATIONS, SUMMARY OF RESULTS FROM ORCHARDS, 1917

TABLE 3.—RESULTS IN 1917

Orchard owners	No. of trees	Age of trees, years	No. of fruit sprays	Cost of material and labor	Profits from spraying
Adair County					
Virgil Darr, Kirksville	15	30	3	$ 5.30	$ 44.70
Chas. Forbes, Kirksville	22	17	2	19.20	85.80
A. R. Cummings, Kirksville	10	15	4	5.80	24.20
Barry County					
W. T. Sallee, Exeter	800	14	3	$ 40.00	$860.00
D. D. Roller, Cassville	300	15	3	100.00	400.00
A. Frost, Cassville	600	16	1	35.00	265.00
Zuma Bloomer, Cassville	75	14	2	10.00	65.00
S. T. Sims, Cassville	100	12	2	15.00	85.00
T. S. Frost, Cassville	21	15-23	3	6.80	56.20
J. C. Elston, Exeter	1660	15	4	238.34	5422.26
Butler County					
M. J. Brock, Poplar Bluff	12	12	1	$ 12.25	$ 87.75
Cape Girardeau County					
G. S. Henderson, Jackson	50	25	1	$40.00	$125.00
R. F. Tuschhoff, Oak Ridge	13	15-20	3	9.90	60.10
M. C. Kieninyer, Pocahontas	18	12-30	3	16.25	50.75
A. Overbeck, Jackson	150	12-14	3	26.00	177.00
Aug. Nothdorft, Jackson	40	20	4	39.20	110.80
J. W. Noland, Neelys	15	30	4	14.07	48.43
A. C. Hope, Pocahontas	20	25	3	22.00	89.00
J. M. Smith, Jackson	20	15-22	4	11.44	88.56
Adam Thoma, Allenville	50	20	3	26.00	49.00
Carroll County					
Mrs. C. H. Heins, Carrollton	1000	15-25	3	$185.00	$615.00
W. E. Miller, DeWitt	300	22	3	97.95	788.92
S. B. Atwood, Carrollton	1500	12-20	4	425.00	6575.00
J. B. Bargold, Wakenda	650	21	4	167.80	3633.70
Chariton County					
John Storm, Brunswick	600	17-27	3	$185.50	$1154.50
J. F. Stowers, Keytesville	450	20	1&2	60.00	740.00
Clinton County					
H. S. Harris, Cameron	8	20	2	$3.75	$38.25
Cooper County					
P. R. Jaeger, Boonville	500	20	1&2	$108.00	$1692.00
Dekalb County					
J. E. Roberts, Maysville	25	14-18	1	$14.90	$135.10
Joe Leonard, Maysville	40	10-20	3	10.00	20.00
Henry County					
Guy C. Hartsock, Deepwater	14	12-16	2	$7.00	$10.50
Knox County					
W. E. Cottey, Edina	300	20	3	$60.00	$440.00
Livingston County					
G. A. Smith, Chillicothe	3000	25	3	$292.00	$2558.00
Madison County					
L. H. Watts, Fredericktown	9	20	3	$2.80	$12.20
J. C. Berryman, Fredericktown	12	50-60	3	19.50	20.50

Orchard owners	No. of trees	Age of trees, years	No. of fruit sprays	Cost of material and labor	Profits from spraying
Nodaway County					
R. V. McKee, Ravenwood	15	12	3	$6.50	$23.50
Pike County					
B. D. Hamilton, Gazette	1000	14	3	$97.00	$1403.00
H. G. McDonald, Clarksville	900	15	2	185 00	4315.00
St. Charles County					
St. Mary Inst., O'Fallon	96	20	2	$39.80	$210.20
Oberle Bros., Weldon Springs	1500	10-20	3&4	200.00	3000.00
Wm. Sehrt, Augusta	56	15	3	35.15	264.85
J. H. Sanford, St. Charles	120	12-25	3	39.25	224.75
M. Schulte, St. Charles	200	16	3	38.47	311.53
A. H. Burns, St. Charles	43	15-20	3	29.95	123.50
St. Francois County					
A. K. Stevenson, Farmington	180	16	2	$23.95	$276.05
Mrs. O. Stracks, Doe Run	10	16	2	6.00	74.00
Wm. Rosenstengel, Doe Run	30	15	3	40.00	110.00
F. L. Graham, Libertyville	24	30-35	1	7.00	43.00
Ste. Genevieve County					
J. J. Gisi, Ste. Genevieve	25	15	2	$30.00	$220.00
St. Louis County					
O. E. Tanzberger, Jefferson Barracks	150	10-30	4	$60.00	$331.00
S. J. Crecelius, Jefferson Barracks	85	15-33	4	60.00	455.15
M. Thurwaechter, Jefferson Barracks	25	30	2	30.00	370.00
F. Tanzberger, Jefferson Barracks	25	35	1	15.00	120.00
Geo. Weinreich, Jefferson Barracks	35	20-30	4	29.00	314.40
Wm. Dorst, Jefferson Barracks	100	15	1	40.00	160.00
Sullivan County					
Porter Bros., Green City	20	15	3	$3.60	$56.40
Sam Yos, Green City	32	20	3	7.64	42.36
John Febus, Green City	40	18	2	13.00	62.00
E. L. Montgomery, Milan	15	10	2	8.00	67.00
T. H. Dewitt, Green City	45	25	3	6.66	43.34

In the orchards listed in Table 3 an average of 2.68 sprays, a little more than two and one-half, were applied in each orchard. The average cost a tree for making the sprays was 19½ cents, approximately seven cents a tree for each spray. The average net profit received from each tree as a result of spraying was $2.28½.

Estimating 50 apple trees to the acre, the approximate cost of labor and materials used in applying 2.68 sprays was $9.75 an acre, and the average net profit received from spraying in the sixty orchards amounted to $114.25 an acre.

COMMENTS OF ORCHARD COOPERATORS, 1917

The following comments were made by the orchard cooperators in submitting their reports concerning the spraying demonstration work for the season, 1917:

Charles Forbes, Kirksville: "The income of the orchard has varied with the season from about $75 to nothing. Would have been very little without spraying this year. Half of the trees didn't bear. Profits from spraying this year, $85."

Virgil Darr, Kirksville: "Some of the later varieties contain some wormy apples, due to inexperience and not using the fourth spray. Can say we are certainly pleased with results obtained."

Emmett Linders, Kirksville: "This is a record of orchard owned by A. R. Cummins, Porter Community, sprayed by me for demonstration. The owner is now fully convinced of the value of spraying apples."

S. T. Sims, Cassville: "I don't take care of my orchard as I should. Spraying is the only extra work I do; but I find that it is as essential as plowing. Average income before spraying, not much, as the apples fell off; profits from spraying, $85."

Martin J. Brock, Poplar Bluff: "I think there ought to be a law forced on the farmer who has fruit trees and does not spray. Average yield before spraying, one-half on account of being spotted and rotten; profits from spraying, $87.75."

Adam Thoma, Allenville: "The summer sprays were not done at the proper time on account of the material being missent. The bluestone was misplaced by the railroad and it took forty days until I could spray, and then the blotch rot developed so rapidly that it destroyed a lot of apples."

M. C. Kienmeyer, Pocahontas: "I know it pays to spray. Average yield before spraying, none. Profits from spraying, $50.75."

J. B. Bargold, Wakenda: "My apples were simply fine, and I am well pleased with the last year's and this year's work. I had the best apples in the county. My trees had a fine coat of leaves on them."

W. E. Miller, DeWitt: "If I had sprayed last June for side worms, I would have had 150 more barrels of good apples. You must remember this lot of trees have had a hard time owing to the three to four seasons of drought. They are doing better now."

John Storm, Brunswick: "On account of hail storm two years ago which battered all bearing wood on south side of the apple trees in this orchard, the trees bloomed on one side only. Income from this orchard before spraying was begun, about $415. Profits after spraying this year, $1,154.50."

J. F. Stowers, Keytesville: "The quality of the fruit was the best ever produced on orchard and while the crop was light, I give the spraying all the credit. I don't think we would have had fifty bushels had we not sprayed. We are well pleased with the results."

Henry S. Harris, Cameron: "The first spray was made when the bloom was about three-fourths fallen and the second three weeks later. Two Jonathan trees were fine and had about twenty-five bushels of fruit. Two other trees were partially dead, but the apples were large and quite good."

P. R. Jaeger, Boonville: "One-third the number of trees were heavily set with fruit, one-third were thinly set, and one-third were without blossoms and fruit."

Joe Leonard, Maysville: "I was so busy I didn't put on the fourth spray. We had no fruit in the unsprayed orchards of the neighborhood."

J. E. Roberts, Maysville: "Our spraying pays us from 500 to 1000 per cent.

Our neighbors who have apples that they don't spray are out of fruit by picking time. Their apples do not stay on the trees, therefore do not keep well. They buy from us."

Guy C. Hartsock, Deepwater: "The results of this experiment in spraying were such that I am fully convinced that spraying is all right and will always spray whenever I have a good set of fruit buds."

G. A. Smith, Chillicothe: "This orchard has not been well pruned or cultivated but is now in far better condition than for many years."

H. G. McDonald, Clarksville: "About half of the sprayed and unsprayed trees were moderately well set with fruit. The remainder were not. Average income from orchard before spraying was begun, not much. Profits from spraying this year, $4,315."

B. D. Hamilton, Gazette: "Only about one-fourth of these trees bloomed. All of the trees had a fine dark green foliage which remained in this condition until frost."

Wm. Sehrt, Augusta: "The labor is for pruning and spraying. Labor for harvesting not included. Income from the orchard before spraying was begun, not much, and some years, nothing. Profits from spraying this year, $264.85."

J. H. Sanfort, St. Charles: "The 200 bushels tabulated is what I sold and does not include what was used and what was kept for winter use. Besides I made nearly 200 gallons of cider which is worth $8 a barrel, would net $32 more for the orchard. Average income from orchard before spraying was begun, $50. Profits from spraying this year, $224.75."

Oberle Bros., Weldon Springs: "We were about to abandon our orchard. Had already neglected it. Now we have taken new life and spirit and are most certain of results. Thankful to you for the inducement. Average yield before spraying, $200 to $500. Profits since spraying, $3,000."

Mrs. O. Stracke, Doe Run: "Before spraying, barely enough for home use; after spraying, $74."

Wm. Rosenstengel, Doe Run: "I think that I was well paid in the quality of fruit, but the quantity was short due to the cold weather just at blooming time."

F. D. Graham, Libertyville: "Cyclone destroyed spray and we gave most of the trees only one spray. Two or three trees sprayed twice: could tell big difference in them. It pays to spray. Want to give all sprays next year."

Joseph J. Gisi, Ste. Genevieve: "I am well pleased with the results of the spraying solution."

O. E. Tanzberger, Jefferson Barracks: "There were over two-thirds of the apple trees that had twig blight and green aphides which you saw when you were down here. Yearly income from orchard before spraying was begun, not any. Profits from spraying this year $331."

S. J. Crecelius, Jefferson Barracks: "About 20 trees were heavily set and about 20 trees were thinly set, while about 45 trees had no fruit on account of blight."

Geo. Weinreich, Jefferson Barracks: "Not a single scale was noticed on my fruit or trees after spraying."

Value of Spraying in St. Louis County

The value of spraying as a means of increasing the production of marketable apples is very well expressed in the following letter from the Kreuger-Thompson, Fruit and Produce Commission Merchants, St. Louis, Mo.:

"Knowing that you would be interested as to the result, also the benefits resulting from the spraying of orchards, we now take the opportunity of informing you of the good work done in the orchards of Mr. Geo. Weinreich, Mr. Sam Crecelius and Mr. Oscar Tanzberger of Oakville, Jefferson Barracks, Mo.; and they have asked us to express to you their appreciation of the above.

"As a direct result of the spraying you have done and as to your suggestions, the above gentlemen were able to realize from ninety to one hundred per cent more money for their apples than their neighbors were able to obtain for fruit not sprayed, also, the quality at the same time was much better and the apples more easily sold, than fruit that was not sprayed.

"We cannot help but add our appreciation of the above good work, and trust the work will go on without interruption, as we feel sure if any one who owns an orchard, were aware of the results of proper spraying, they would not for a minute put off spraying for the immense benefits obtained, for the small amount of money invested."

Porter Bros., Green City: "Forty bushels harvested in fall. Fifteen bushels given away (windfalls). We must have used between 15 and 20 bushels. Average income before spraying, $35. Profits from spraying this year, $56.40."

John Febus, Green City: "Didn't spray last time on account of rainy weather. Am certain spraying is a great help."

E. L. Montgomery, Milan: "Most of these trees were too full and resulted in many apples being small, which were left on ground and not included in above estimate. Income from orchard before spraying was begun, practically nothing last three or four years. Profits since spraying, $67."

UNUSUAL CONDITIONS DURING THE SEASON 1918

The apple growers of Missouri experienced many difficulties in their work during the season of 1918. The cold damp weather at blooming time interfered materially in securing a satisfactory set of fruit by preventing the honey bee and other insects from properly pollinating the apple blossoms. The shortage of labor required some growers to drop the spraying work entirely and the majority of orchardists were forced to reduce the number of sprays or content themselves with inefficient labor. Spraying equipment and chemicals of every kind advanced in price, causing many orchardists to discontinue spraying work for the season and others to use equipment and materials that were not satisfactory. The unusual and extremely dry weather extending from June to September caused failures in many orchards and reduced materially the yield in practically all orchards in the state.

In spite of these unfavorable conditions, spraying proved to be a very profitable orchard operation. Evidence on this point is furnished by the records of forty-two demonstration orchards listed in Table 4. These records are regarded as particularly significant because they indicate that almost regardless of cost of materials and labor or weather conditions, spraying is to be considered as an investment rather than as an expense.

SUMMARY OF RESULTS ORCHARD DEMONSTRATION WORK
1918

Table 4.—Results in 1918

Orchard owners	No. of trees	Age of trees, years	No. of fruit sprays	Cost of material and labor	Profits from spraying
Adair County					
Charles Forbes, Kirksville	23	5-18	3	$14.00	$86.00
G. W. Newton, La Plata	300	12-24	1	30 00	770.00
Mrs. Laura E. Hibbard, Kirksville	40	15-26	2	17.00	43.00
Barry County					
L. N. McFarland, Cassville	400	18	2	$75.00	$525.00
A. Frost, Cassville	500	17	1	40.00	460.00
W. T. Sallee, Exeter	600	15	3	50.00	1550.00
C. D. Manley, Cassville	1000	16	1	50.00	350.00
J. C. Elston, Exeter	1600	15	3	607.40	1663.73
Butler County					
W. S. Melton, Poplar Bluff	25	11	2	$9.00	$41.00
Cape Girardeau County					
G. C. Kinder, Daisy	25	18	3	$ 3.00	$47.00
Joseph Job, Cape Girardeau	45	9	2	15.00	15.00
J. J. Holtz, Cape Girardeau	60	14	3	11.60	41.40
Sam Jones, Jackson	27	17-24	3	7.10	26.70
H. Ludwig, Pocahontas	65	15-18	4	12.00	18.00
B. L. Hitt, Advance	80	16	3	40.00	110.00
E. A. Bedwell, Oak Ridge	25	16	3	10.37	19.63
M. C. Kienmeyer, Jackson	15	14	5	9.00	11.50
Carroll County					
J. B. Bargold, Wakenda	600	22	4	$144.00	$1156.00
Clara Heins, Carrollton	600	10-25	2	150.00	850.00
R. D. Jay, Carrollton	600	18-20	3	250.00	150.00
Cooper County					
P. R. Jeager, Boonville	450	20	1	$160.00	$2840.00
Dekalb County					
J. E. Roberts, Maysville	20	18	4	$12.31	$147.69
Franklin County					
Harry Barrett, New Haven	90	20	1	$12.00	$263.00
Johnson County					
R. T. McDougal, Holden	212	16	2	$37.50	$400.00
Knox County					
S. W. Myers, LaBelle	35	3-20	3	$7.00	$38.00
Livingston County					
G. A. Smith, Chillicothe	4000	25	4	$600.00	$3900.00
Miller County					
Julius Wagener, Eldon	200	4-11	1	$16.00	$234.00
Pike County					
B. D. Hamilton, Gazette	1000	15	1	$30.00	$2670.00
St. Charles County					
Oberle Bros., Weldon Spring	3000	5-20	3	$500.00	$6771.39
T. Mallincksocht, Augusta	50	25	2	33.50	91.50
St. Marys Inst., O'Fallon	100	25	3	38.80	36.20
Alfred Nahm, Augusta	40	10-30	1	6.00	54.00

TABLE 4.—RESULTS IN 1918

Orchard owners	No. of trees	Age of trees, years	No. of fruit sprays	Cost of material and labor	Profits from spraying
		St. Francois County			
A. K. Stevens, Farmington	200	18	3	$35.48	$136.37
Mrs. O. Stracke, Doe Run....	10	18	2	5.00	5.00
W. E. Matkin, Farmington....	60	15	1	25.00	105.00
H. Strong, Bonne Terre........	50	20	4	16.00	14.00
		St. Louis County			
Oscar Thurwalchter, Jefferson Barracks	45	25-30	3	$25.00	$475.00
O. E. Tanzberger, Jefferson Barracks	36	14-30	3	17.00	711.85
William Dorst, Jefferson Barracks	100	15-20	1	25.00	225.00
Geo. Weinreich, Jefferson Barracks	35	30	2	21.00	599.45
Fred Tanzberger, Jefferson Barracks	30	30	1	9.95	30.05
		Sullivan County			
Porter Bros., Green City......	20	15	1	$2.50	$17.50

In the 48 orchards listed in Table 4 an average of 2.38 sprays, a little more than two and one-fourth sprays, were applied in each orchard. The average cost a tree for making the 2.38 sprays was nineteen cents or about eight cents a tree for each spray. The average net profit received from each tree as a result of spraying was $1.69.

Estimating 50 apple trees to the acre the approximate cost of labor and materials used in applying 2.38 sprays was $9.50 an acre, and the average net profit received from spraying in the 42 orchards amounted to $84.50 an acre.

REPORTS OF COSTS AND PROFITS

In every case the orchard cooperator kept an accurate account of the cost of the spraying materials and the labor used in the spraying demonstration work. In obtaining the net profit the cost of materials and labor was deducted from the value of the fruit used and sold. At the close of the season each cooperator was requested to make an itemized statement of all the work performed in the orchard including the cost of spraying materials and the cost of labor in applying the sprays. The report did not, however, include the cost of spraying equipment.

The cost of spraying materials varied considerably due to the fact that some cooperators purchased in small quantities from local dealers and paid high prices while others clubbed their orders and purchased thru their home dealers or direct from the manufacturers in carload lots, paying the lowest prices. The cost of labor also varied due to local conditions, such as inefficient labor and spraying outfits, proximity of the orchard to a water supply, the size and condition of the trees and the character of the ground over which the spraying operations were conducted.

The value of all the demonstration orchards has been increased but this has not been considered in making the report of costs and profits. For this reason no interest has been charged against the permanent investment. The value of any particular orchard depends upon the average net returns from the orchard over a period of from three to five years.

RECOMMENDATIONS

The results obtained in the orchard-spraying demonstration work as described in this circular and a careful review of other observations, experiences and recommendations, indicate that apple trees should be sprayed at the times and in the manner outlined in the general spray calendar.

GENERAL SPRAY CALENDAR FOR APPLES

What to Spray For	*When to Spray and What to Use*
1. San Jose scale Other scale insects Plant lice (aphides)	**Dormant or San Jose scale spray** Spray after leaves drop in fall, during warm days in winter, in spring as leaf buds open, or it may be delayed until the cluster buds separate and show pink and eliminate cluster bud or first summer spray. Use lime-sulphur, 6 or 7 gallons to 50 gallons of water. Unnecessary to use concentrated spray unless scale is present. Arsenate of lead is not required in this spray.
2. Apple scab Plant lice (aphides) Curculio Canker worm Cedar rust Black rot leaf spot	**First Summer or Cluster-Bud Sprays** When cluster buds are separating and the pink color of buds appear, but before the blossoms open. Generally this spray must be made within a period of 3 to 5 days. Application unnecessary when scale spray is delayed until this time. Lime-sulphur 1½ gallons, and arsenate of lead paste 2 pounds, or powder 1 pound, to 50 gallons of water; or bordeaux (3-4-50) and arsenate of lead. Nicotine sulphate, ½ pint to fifty gallons spray mixture when plant lice are abundant. This spray ranks third in importance as a summer application, and if scale is present it may be ranked as first.

GENERAL SPRAY CALENDAR FOR APPLES (*Con't.*)

What to Spray For	*When to Spray and What to Use*
3. Codling moth Plant lice Apple scab Curculio Black rot leaf spot Lesser apple worm Canker worm Cedar rust	**Second Summer or Calyx-cup Spray** Spray when petals or blooms are two-thirds off and finish before the blossom ends close. For best results spray must be made within 4 or 5 days. Do not spray while trees are in full bloom as the spray may kill honey bees and prevent a satisfactory set of fruit. Lime-sulphur 1½ gallons, and arsenate of lead, paste 2 pounds or powder 1 pound, to 50 gallons of water. Nicotine sulphate ½ pint to 50 gallons of spray mixture when plant lice are abundant. Most important summer spray and should never be omitted. It is very important that this spray be thoroly applied.
4. Curculio Apple blotch Codling moth Lesser apple worm Black rot leaf spot	**Third Summer or Curculio and First Blotch Spray** Apply within 14 to 20 days after calyx-cup spray. If curculio injury is severe make application earlier or within 7 to 10 days after calyx-cup spray. Lime-sulphur 1¼ gallons, and arsenate of lead, paste 2 pounds or powder 1 pound, to 50 gallons of water. If apple blotch is severe use bordeaux (3-4-50) and arsenate of lead instead of lime-sulphur. This spray is next in importance to the calyx-cup or second summer spray and should be applied in every Missouri orchard.
5. Curculio Codling moth Apple blotch Lesser apple worm Sooty blotch	**Fourth Summer Spray** Apply five or six weeks after the calyx-cup spray or if No. 4 is made within 7 to 10 days after calyx spray, make No. 5, two or three weeks later. Lime-sulphur 1¼ gallons and arsenate of lead, paste 2 pounds or powder 1 pound, to 50 gallons of water. If apple blotch is severe, use bordeaux (3-4-50) instead of lime-sulphur.

GENERAL SPRAY CALENDAR FOR APPLES (*Con't.*)

What to Spray For	*When to Spray and What to Use*
6. Codling moth Lesser apple worm Apple blotch Bitter rot Sooty blotch Curculio	**Fifth Summer Spray** Apply about three or four weeks after No. 5, or eight to ten weeks after calyx-cup spray. Lime-sulphur 1¼ gallons, and arsenate of lead, paste 2 pounds or powder 1 pound, to 50 gallons of water. If apple blotch or bitter rot is serious use bordeaux (3-4-50) and arsenate of lead instead of lime-sulphur.

EXPLANATION OF GENERAL SPRAY CALENDAR FOR APPLES

Lime-sulphur as referred to in the spray calendar means the commercial solution testing 33° Baume.

Bordeaux has reference to bordeaux mixture made according to the 3-4-50 formula (3 lbs. bluestone, 4 lbs. quick lime to 50 gallons of water).

The sprays beginning with the cluster-bud application are generally known as the first summer spray, second summer spray, third summer spray, etc. Since practically all fruit growers who spray their orchards never omit the calyx-cup or second summer spray, the time for applying the later applications may be based upon the date of the calyx-cup spray.

In the foregoing spray schedule, for example, the recommendations are to use 1½ gallons of lime-sulphur to 50 gallons of water and 2 pounds of arsenate of lead paste or 1 pound of the powder. In reality 1½ gallons of lime-sulphur is to be used in 48½ gallons of water or the lime-sulphur is to be used at the rate of 1½ gallons to a spray barrel or spray tank, having a capacity of fifty gallons. At this proportion a spray tank of 100 gallons capacity would require 3 gallons of lime-sulphur and 4 pounds of arsenate of lead paste or 2 pounds of the powdered arsenate of lead, while a spray tank of 200 gallons capacity would require 6 gallons of lime-sulphur and 8 pounds of arsenate of lead paste or 4 pounds of the powder.

Additional sprays may be necessary to control insects or fungous diseases requiring special attention. When the fruit crop is in danger spray without delay, using the proper spraying mixture.

SUMMARY OF RECOMMENDATIONS

1. **Dormant or San Jose scale spray.**—This spray is used principally for the control of San Jose scale. It may be applied in the fall after the leaves drop, during nice weather in the winter, or it may be delayed until after growth starts in the spring. Recent experiments and observations also show that under Missouri conditions the dormant spray consisting of the lime-sulphur may be applied to apple trees without material injury to their leaves or flower buds at the time for the first summer or cluster-bud spray, in which case the dormant spray takes the place of the first summer application. (For more detailed in-

formation regarding the application of the delayed dormant spray, see Bulletin 161 of the University of Missouri, College of Agriculture.) The most effective period for the dormant or San Jose scale spray is after growth starts in the spring and until the flower buds separate and show their pink petals, but before the blossoms open.

The commercial lime-sulphur solution or the homemade lime-sulphur solution should be used because it is just as effective as the miscible oil sprays in killing San Jose scale if thoro work is done, and in addition to being an insecticide it is also a powerful fungicide. The lime-sulphur solution is also less expensive than the miscible oil sprays. The commercial lime-sulphur testing 32 degrees Baume should be used at no greater dilution than six or seven gallons to a spray barrel or tank having a capacity of 50 gallons. This is equivalent to one gallon of the concentrated solution to seven gallons of water.

The homemade lime-sulphur made according to the standard formula, of 40 pounds unslacked stone lime, 80 pounds of sulphur (powdered commercial) to 50 gallons of water should give a solution testing about 1.23 to 1.25 on the specific gravity hydrometer or about 27 to 29 degrees Baume, and should be diluted at the rate of about eight or nine gallons to a spray barrel or tank having a capacity of 50 gallons. Since the density or strength of the homemade product often varies greatly, definite testing of all homemade concentrates is necessary. This may be easily done with an orchard hydrometer which can be purchased from almost any druggist or lens company or from many of the companies handling spraying materials, at a cost of $1 to $1.50 for a complete outfit.

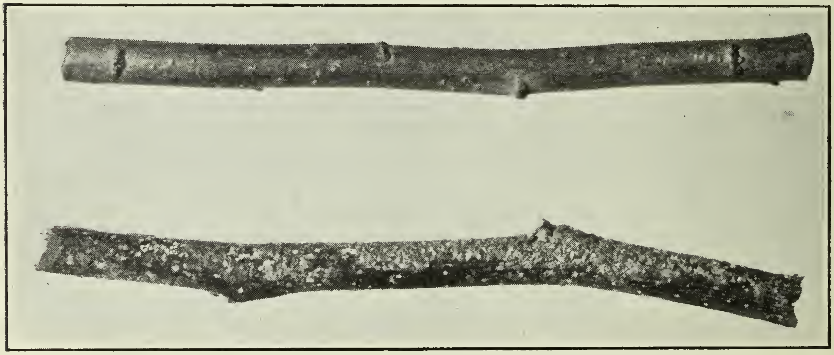

FIG. 3.—Apple branch infested by San Jose scale (below). Above, healthy or noninfested branch

In orchards where San Jose scale is not present the dormant spray is not required. It is true that the spray will do the orchard no harm if properly applied but it is doubtful if it will benefit the apple trees enough to pay for the expense of labor and material unless San Jose scale is present. Some growers make a mistake by applying the dormant spray where it is not needed and by omitting one or two of the late summer sprays which are required. The application of the dormant spray costs approximately as much as two summer sprays. In the average orchard where scale is not present the application of one or two additional summer sprays, made at the proper time, will do much more toward the production of clean marketable fruit than the application of a dormant spray.

The foregoing statement is not for the purpose of discouraging the application of the dormant spray in orchards which are receiving all the required summer sprays. It is rather to emphasize the fact, however, that if scale is not present and any of the sprays are to be omitted, it is much better to omit the dormant spray than the summer sprays which are needed for the protection of the fruit against insect pests and fungous diseases.

Where San Jose scale is present it will be necessary to apply the dormant spray almost every year in order to keep the insect pests from spotting the fruit and damaging the trees. This should be a very thoro and drenching spray, because it is necessary to hit and wet every tiny scale insect. The twigs, branches, large limbs and trunks of the trees should be sprayed from every angle and thoroly covered with a concentrated spray. Average sized apple trees from 15 to 18 years of age will require from four to six gallons a tree if the work is properly done, while older trees may require from seven to twelve gallons a tree.

2. **First summer or cluster-bud spray.**—Almost every Missouri apple orchard will produce more and better fruit if the first summer spray is applied. Apple scab, the most important fungous disease to control at this time and the spring canker worm and plum curculio, usually the most injurious insects if present, can be successfully controlled with this spray.

In general, for Missouri orchards, the most satisfactory spraying solution to use is commercial lime-sulphur concentrated (1½ gallons to 50 gallons of water) or bordeaux (3-4-50) and two pounds of paste arsenate of lead or one pound of the powder in every 50 gallons of spraying solution.

When plant lice or aphides are numerous on the buds and leaves, the tobacco extract known as nicotine sulphate should be added to the lime-sulphur arsenate of lead or bordeaux spraying solution at the rate of ½ pint to 50 gallons.

This summer spray should be applied when the apple flower buds begin to separate and show their pink petals but before the blossoms open. An average

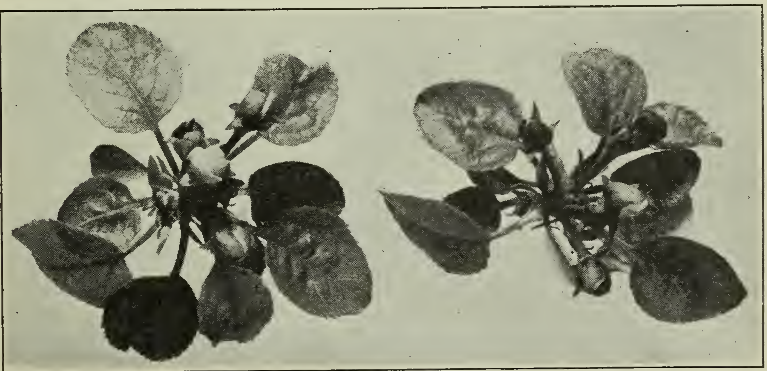

Fig. 4.—Cluster of apple buds in the "pink" stage, when the cluster-bud or first summer spray should be made

of the dates when this spray is generally made in Missouri is: For the southern third of the state, April 4 to 9; central third, April 10 to 17; northern third, April 19 to 25. The actual dates on which this spray should be applied may vary from four to seven days earlier or later than the dates mentioned depending upon the development of the fruit buds for the season. The dates given, however, are approximately correct and may be a guide for the beginner who should have no difficulty in selecting the time to spray if the fruit buds are observed carefully from day to day at this period.

For best results this spray should be applied within a period of four or five days. In large commercial orchards, the growers frequently have to begin spraying before the cluster buds separate in order to finish before the flower buds open. It is important therefore that the spraying equipment be in order and that spraying materials be on hand in sufficient quantities for the applications, otherwise a few days' delay may allow the fruit trees to come into bloom in which condition the trees should not be sprayed.

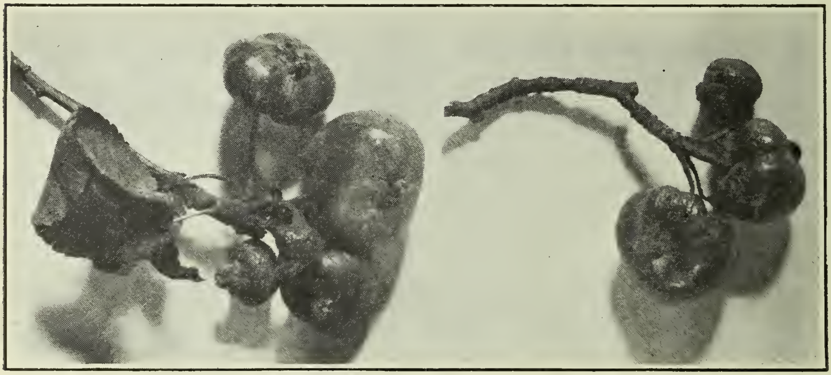

FIG. 5.—Apples dwarfed, gnarled and ruined by plant lice (aphides)

3. **Second summer or calyx-cup spray.**—The so-called calyx or blossom-fall spray is the most important single summer spray of the season. It not only controls the first brood of the apple worms or larvae of the codling moth, but it also prevents, to a great extent, the losses occasioned by the later broods of this insect pest. It is also an effective spray against the lesser apple worm, plum curculio, canker worms, and such diseases as apple scab, black rot, and other less important insect pests and fungous diseases.

This spray must be applied for best results immediately after the blossoms or petals fall. The trees should not be sprayed while in full bloom, because the reproductive organs of the flower (stamens and pistil) fill and almost close the calyx-cup, thus preventing the poison spray from reaching the place where the majority of the codling moth worms take their first meal. At this time the little green calyx lobes are turned down in such a way that it is very difficult to coat them with the spraying solution and consequently the small developing apples are not protected well against apple scab.

Spraying apple trees when they are in full bloom is also apt to prevent a satisfactory set of fruit. The spraying solution may be strong enough to burn

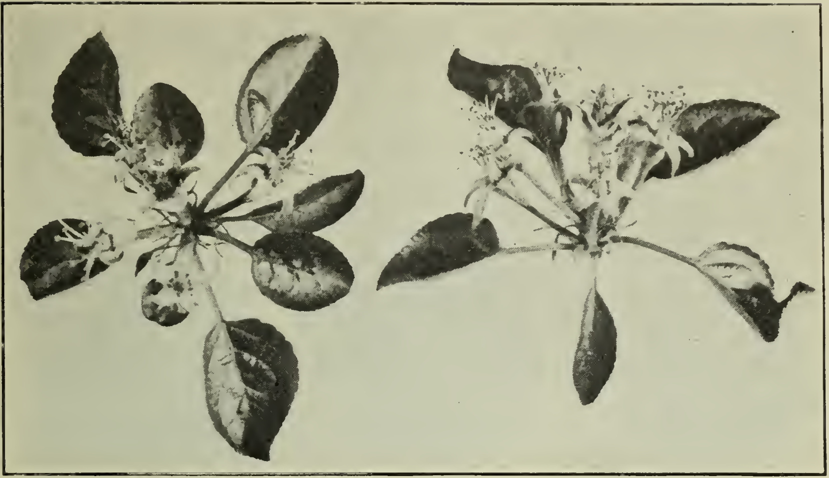

FIG. 6.—Time for the second summer or calyx-cup spray, the most important summer application. The blossoms or petals have just fallen and the calyx-cups are wide open

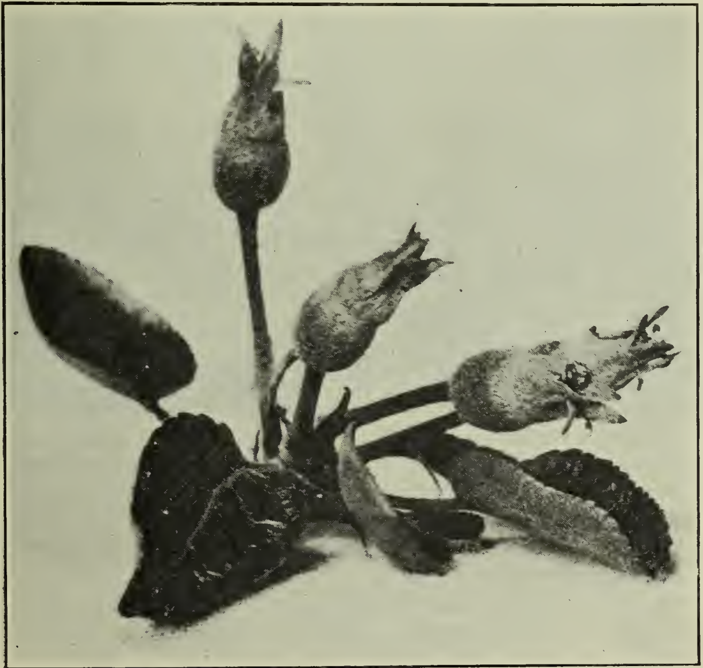

FIG. 7.—Too late for calyx-cup spray to be effective in controlling codling moth, as the calyxes of the young apples have closed

the stamens and pistils. Also, it may be applied with enough force to destroy these reproductive organs of the flowers.

When about two-thirds of the petals have fallen, the spraying work may begin. Practically all the nectar will have dried by this time and but few bees will be found visiting the flowers. No injury can, therefore, be done to the bees if the spray is applied immediately after the petals fall or when the nectar has stopped flowing. Use lime-sulphur solution and arsenate of lead in the same proportion as for the cluster bud spray, one and one-half gallons lime-sulphur and two pounds of arsenate of lead paste, or one pound of the powder to 50 gallons of water. Bordeaux is not recommended for this spray on account of the danger of injuring the young fruit by burning or russeting.

Since the little cavity at the blossom end of the apple, known as the calyx-cup, remains open for only a week or ten days, for most varieties of apples, the spray should be applied, if possible, within from four to seven days after the petals fall in order to be most effective in killing the apple worms. A large percentage of these worms upon hatching from the eggs of the codling moth take their first meal in the calyx-cup of the little apples. If the fruit growers are careful in applying the spray, a little arsenic will be placed in the calyx-cup of each young fruit, and the first meal the apple worm takes will be its last one.

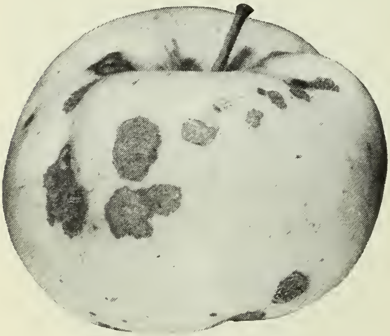

FIG. 8.—Fruit showing characteristic spots of apple-scab injury

This should be the most thoro spray of the season. A nozzle throwing a rather wide fog-like spray with considerable force will generally give best results. The spraying equipment employed should furnish sufficient pressure to force the spray to all parts of the tree without difficulty. If thoro work is done, the young apple clusters must be sprayed from every angle in order to cover the leaves and fruits on all sides and to force the poison spray into each tiny calyx-cup. Apple trees from 12 to 18 years old may each require from five to seven gallons of the spraying solution, while larger trees ranging from 18 to 25 years old may need from 8 to 12 gallons of the spray to cover them thoroly.

4. **Third summer or curculio and first blotch spray.**—It is necessary to apply the third summer spray in from ten days to three weeks after the calyx or blossom-fall spray. Where curculio injury is severe this spray should be made within seven to ten days after the calyx spray to prevent injury to the little apples. This spray continues to prevent injury to the young fruit and leaves of the apple trees by keeping them covered with the lime-sulphur or bordeaux and arsenate of lead.

The most injurious insect pest to control at this time is the plum curculio. This little snout beetle makes crescent or half-moon shaped cuts on the apples in depositing its eggs and it also cuts tiny holes in the fruit in feeding. These blemishes in the skin damage the appearance of the fruit and reduce its quality and market value. The feeding punctures usually greatly outnumber the egg crescents. Many of the miniature apples drop early from the effect of these stings.

Since the plum curculio generally does its greatest damage to the fruit within ten days or two weeks after the time for the calyx spray it is often advisable to apply a spray in from seven to ten days after the calyx spray in apple orchards badly infested by this insect. In orchards where the injury of the pest has not been severe the spray may be applied in from two to three weeks after the calyx or second summer spray, and this is the time at which it is usually made.

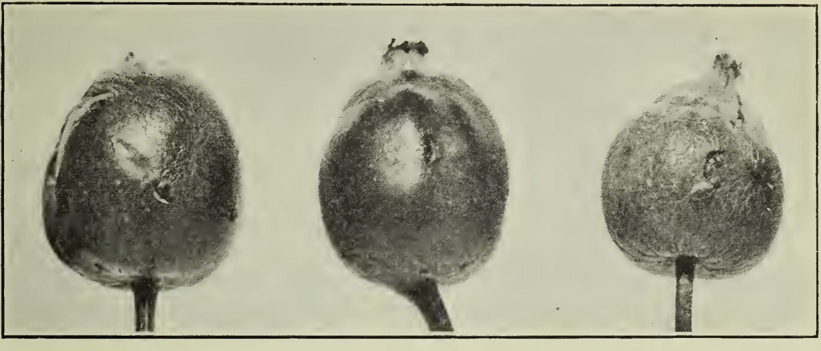

FIG. 9.—Work of plum curculio in scarring and deforming young apples. Many of the fruits drop as a result of such injury

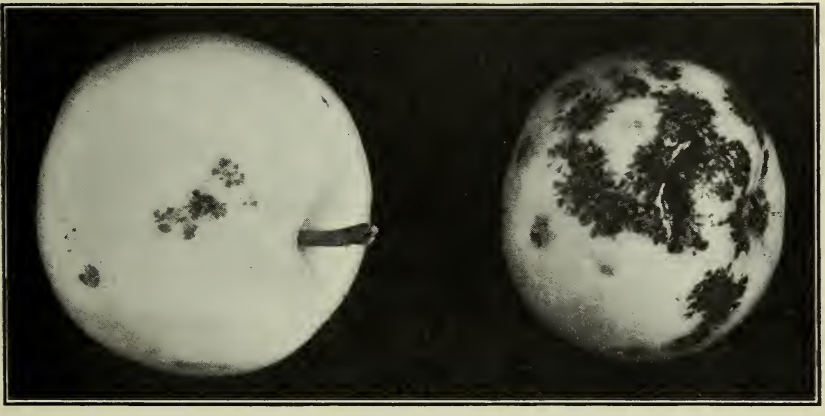

FIG. 10.—Fruit injured by apple blotch

In addition to being the most important spray against the plum curculio this is also the most effective application in preventing the fungous disease known as apple blotch. This disease produces irregular-shaped brownish colored spots on the skin of the apple. These spots may cover the entire surface of the fruit, causing deep cracks in the apples and making them practically worthless. Such varieties as Missouri Pippin, Huntsman, Ben Davis and Gano are very susceptible to apple blotch injury especially in South Missouri.

Where apple blotch has been serious or difficult to control bordeaux and arsenate of lead should be used for this spray instead of lime-sulphur and arsenate of lead because bordeaux will control the apple blotch disease better than lime-sulphur.

5. **Fourth summer spray.**—In central and south Missouri and in most of the orchards in north Missouri the third summer spray should be followed in about three or four weeks by another application. This is for the purpose of protecting the apples against the ravages of the second brood codling moth, plum curculio, lesser apple worm, apple blotch, black rot and bitter rot. If injury from apple blotch and bitter rot is anticipated, bordeaux and arsenate of lead should be used instead of lime-sulphur and arsenate of lead.

If the third summer spray is applied in seven to ten days after the calyx-cup spray the fourth application should be made within two or three weeks after the third summer spray. In orchards where the third summer spray is applied in from seven to ten days after the second summer spray it is important in all parts of the state that at least the fourth summer application be made.

6. **Fifth summer spray.**—This spray is particularly for the control of the second brood codling moth, the lesser apple worm, plum curculio, apple blotch and bitter rot. In some instances it is a very important spray for protection against bitter rot.

It is made three or four weeks after the fourth summer spray or approximately eight to ten weeks after the calyx-cup spray. The date will vary from about July 1 in the extreme southern part of Missouri to about July 25 in the northern part of the state.

7. **Extra summer sprays.**—Additional sprays may be necessary as safeguards against bitter rot or the second and third brood codling moth and lesser apple worm. Where bitter rot has been serious spraying with bordeaux should begin about the first of July and be repeated at intervals of ten days until three or four applications have been made. One or two extra sprays may be needed in some orchards especially in the southern part of the state to control the late broods of the codling moth and lesser apple worm. Where this is necessary, use bordeaux and arsenate of lead, at intervals of two weeks until all danger is past.

STANDARD SPRAYING MIXTURES: FORMULAS AND PREPARATION

Commercial Lime-Sulphur Solution

The commercial lime-sulphur solution may be purchased from the manufacturers or dealers in practically all of the larger towns and cities of the state. In many orchard communities the fruit growers club their orders and buy their supplies thru the local dealers or direct from the manufacturers in car lots. The product of practically all the manufacturers are of about the same strength or density and may be reduced to the proper strength by the addition of water.

The different brands of commercial lime-sulphur vary according to the amount of lime and sulphur which they contain. By the use of an orchard hydrometer the density of any particular brand can be determined. Most of the commercial brands should test from 33 degrees to 35 degrees on the Baume scale.

Homemade Concentrated Lime-Sulphur

A concentrated solution can be made from the following formula, testing from 27 degrees to 29 degrees Baume, which is almost exactly like the commercial brand so far as composition and effectiveness when used is concerned:

Lime (burnt or stone)	40 lbs.
Sulphur (flowers of flour)	80 lbs.
Water	50 gal

Add the lime to a large kettle or vat and start it to slaking with a small quantity of water and when the action is vigorous pour in the sulphur and mix thoroly with the lime. Sufficient water should be added from time to time to prevent the lime from drying out during the process of slaking. As soon as the lime is thoroly slaked and the sulphur thoroly mixed, enough water is added to bring the total volume to 50 gallons. Boiling is then continued for 45 to 50 minutes, water being added as needed to keep the volume at 50 gallons. After the boiling is completed the lime-sulphur can be diluted and used at once or it may be stored in tight barrels for future use. The lime and sulphur may be mixed and boiled in iron kettles heated over outdoor fireplaces made for the purpose or the boiling may be done by steam.

The homemade concentrated lime-sulphur may be used with equally as good results as the commercial solution for making the dormant spray or the summer sprays provided the strength of the homemade product is tested carefully with an orchard hydrometer and the solution diluted according to the accompanying table.

Dilution Table for Lime-Sulphur

Baume reading,	To make 50 gallons summer sprays		To make 50 gallons dormant sprays	
Degrees	Lime-sulphur, gallons	Water, gallons	Lime-sulphur, gallons	Water, gallons
35	1¼	48¾	5¾	44¼
34	1½	48½	6	44
33	1½	48½	6¼	43¾
32	1½	48½	6½	43½
31	1½	48½	6¾	43¼
30	1¾	48¼	7	43
29	1¾	48¼	7¼	42¾
28	1¾	48¼	7½	42½
27	2	48	8	42
26	2	48	8½	41½
25	2	48	8¾	41¼
24	2¼	47¾	9¼	40¾
23	2¼	47¾	9¾	40¼
22	2¼	47¾	10¼	39¾
21	2½	47½	11	39
20	2½	47½	12½	37½

Making and Buying Lime-Sulphur Solution

Where the fruit grower is not prepared to make the lime-sulphur and has only a comparatively small amount to use, he will usually get much better results in his orchard and find the work a great deal more satisfactory by buying the commercial product. Some of the larger orchardists also state that they can buy commercial lime-sulphur at prices so low that they cannot afford to make it at home. There is close competition in the sale of the solution and the profits are small. The fruit grower will, therefore, usually find it to his advantage to buy the chemical product rather than make it. It is also a fact that the commercial solution is more uniform in density and generally gives better results in the hands of the fruit growers than does the homemade product.

BORDEAUX MIXTURE

The following formula for making bordeaux mixture has given very satisfactory results in the spraying demonstration work:

Blue vitriol (copper sulphate)	3 pounds
Stone lime (unslaked)	4 pounds
Water	50 gallons

If only 50 gallons of the bordeaux is to be made, dissolve the copper sulphate or bluestone in two or three gallons of water. Hot water will hasten the dissolving of the bluestone. Make the solution up to 25 gallons by adding water. Slake the lime in another container and make it up to 25 gallons with water. The two solutions should be kept separate until ready for use when they should be poured together at the same time thru a strainer into the spray barrel or tank. Add to the mixture two pounds of arsenate of lead paste or one pound of the powder after it has been mixed with a small quantity of water and stirred to a thin paste.

Since the copper sulphate solution injures iron or tin containers, it should be prepared in stone or wooden vessels.

Where greater quantities of bordeaux are to be made, the work may be greatly facilitated by dissolving and slaking larger amounts of copper sulphate and lime. Stock solutions containing two pounds of copper sulphate and two pounds of lime to the gallon may be prepared in separate barrels or other containers and kept for an indefinite period, if evaporation is prevented.

For example, place 50 pounds of copper sulphate in a gunny sack or cloth bag and hang it in a barrel or keg of water so that it is just below the surface of the water. If this work is done in the evening practically all of the copper sulphate will be dissolved by morning. After the copper sulphate is dissolved, add water to make 25 gallons.

Slake 50 pounds of stone lime slowly and preferably with hot water. After the slaking process is entirely finished, add water to make 25 gallons.

We now have stock solutions as follows: 25 gallons copper sulphate solution containing 50 pounds, and 25 gallons lime solution containing 50 pounds.

If it is desired to make 100 gallons of bordeaux, stir the stock solution of copper sulphate thoroly. Dip out three gallons and pour it into a barrel or other container having at least a capacity of 50 gallons. Add water to make 50 gallons of dilute copper sulphate. Stir the stock solution of lime thoroly. Dip out four gallons and pour it into another barrel or container having a capacity of at least 50 gallons, and add water to make 50 gallons of dilute lime solution.

The two dilute solutions should then be poured or run together thru pipes to the strainer emptying into the spray tank. This may be accomplished by one person dipping from the copper sulphate solution and one from the lime solution and both pouring the solutions simultaneously thru the strainer into the spray tank.

The most satisfactory way, however, of preparing large quantities of bordeaux is by means of an elevated platform higher than the spray tank. On this platform may be placed the stock solution containers, dilute solution containers and other needed equipment. By elevating the stock solutions and connecting the containers by means of pipes, the mixing may be easily made by gravity. Water should also be supplied by a tank or pump.

The two dilution tanks should be so connected that the contents of each will flow into a common pipe and from that into the strainer attached to the spray tank.

The stock solutions should never be brought together before being diluted because a chemical action results which may russet or burn the fruit and foliage of fruit trees.

ARSENATE OF LEAD

Arsenate of lead in the paste or powdered form may be used effectively. It should be remembered, however, that since the paste is 50 percent water only half as much of the powder is required for any given amount of spray. The spraying demonstration work has shown that one form of the arsenate of lead is just as effective as the other in controlling biting and chewing insects.

In using either the paste or powder, it is advisable to mix the poison in a small quantity of water, stirring to a thin solution before adding it to the spray barrel or tank. To prevent the arsenate of lead from settling to the bottom of the spray barrel or tank, after which it is often difficult to stir it up again, the poison should not be added to the spraying solution until just before the work begins.

The common practice is to fill the tank partly with water, then add the lime-sulphur and finish the filling of the barrel or tank with water, after which the arsenate of lead which has been thoroly mixed with about a gallon of water is added. Where power outfits are being used it is advisable to start the engine when the arsenate of lead is added in order to keep the solution thoroly stirred by the agitation until the spray is applied. If the arsenate of lead is added to the spray just before driving to the orchard, the solution is usually agitated sufficiently by the jolting of the barrel or tank to prevent the poison from settling.

NEW SPRAYING MIXTURES

The manufacturers of spraying mixtures are from time to time putting upon the market new products for the use of fruit growers in spraying their orchards. Many firms also employ highly trained and competent men to assist in testing and standardizing their products before they are offered for sale. Such work on the part of the manufacturer is commendable because there is a great opportunity for improvement in our spraying mixtures.

If all the new products offered for sale would do what is claimed for them, the orchardist should not hesitate to purchase and use them at once. Experience has shown, however, that they are often disappointing. In justice to both the orchardist and the manufacturer the standard spraying mixtures should not be abandoned too quickly. At least three or four seasons are required to test the value of any particular product. It would be much safer therefore to use new spraying mixtures on a small block of trees for three or four years in order to observe and compare the results with those obtained by the use of standard mixtures before buying the new product for use over all the orchard. Such a precaution may mean much to the grower who has a valuable fruit crop at stake.

The Experiment Station of the College of Agriculture of the University of Missouri is testing as many of the new spraying mixtures as possible and will be glad to give an unbiased report of the results obtained in using any particular spraying product.

SPRAYING EQUIPMENT AND ACCESSORIES

The spraying equipment should be such that thoro work may be done, otherwise the results obtained by spraying will be disappointing. If suitable equipment is obtained less time and labor will be required in making the sprays. Since the most important sprays must be applied within a few days for best results, the opportunity for protecting the fruit against the ravages of insects and plant diseases is greatly increased if the spraying equipment is what it should be. Delays caused by inferior or insufficient equipment may mean heavy financial losses.

A few of the essentials in spraying equipment may be summarized as follows:

Small spraying outfits.—The hand atomizers, bucket pumps, knapsack pumps, and compressed air pumps may be used effectively in spraying a few small trees or shrubs. They may also be used with good results in spraying truck and garden crops. They are not suited for spraying bearing apple trees and the results generally obtained by using such equipment in the orchard will not be satisfactory.

Barrel pumps.—Apple orchards of from four to six acres may be sprayed efficiently with a good type of barrel pump sprayer. Every outfit of this kind should be equipped with a good agitator to keep the spray solution well mixed and a strainer at the bottom of the pump to prevent clogging the nozzles with particles of dirt.

Tank pumps.—With an orchard of from five to ten acres a double acting tank pump will be much more satisfactory than a barrel pump. Such a pump will maintain sufficient pressure for good work and since the tank may have a capacity of 100 to 150 gallons considerable time is saved in refilling. This is especially true where the orchard is some distance from the water supply.

Power sprayers.—Bearing orchards of 10 to 25 or 30 acres can be most economically and efficiently sprayed with a gasoline power sprayer. Since a continuous high pressure is desired in order to obtain the best results in spraying the gasoline power sprayer comes nearer meeting the requirements than any other type of power outfit.

SPRAYING ACCESSORIES

A spraying outfit is not complete unless it is equipped with all the useful accessories required for rapid and thoro spraying. Frequently a few dollars spent for such equipment will enable the orchardist to spray more effectively, with less difficulty and finish the work in from one-half to three-fourths the usual time.

Spray hose.—It is economy to buy the best grade of high pressure hose. Hose about ⅜ to ½ inch inside diameter should be satisfactory for spraying work. The length of the hose will depend upon the kind of outfit used, distance between the rows, and size of the trees. In mature commercial orchards the average length should be about 35 to 50 feet. Barrel pumps and tank pumps should be supplied with not less than 25 to 35 feet of hose. In every case the hose should be long enough to permit the spray men to work around the trees without difficulty.

Shut-off.—This is a convenient device for cutting off the spray material whenever desired. It connects the spray hose with the spray rod. Its use saves spraying material and enables one to adjust or clean the nozzles quickly in case of clogging.

Extension rods.—The extension rod may consist of a one-fourth inch gas pipe or a bamboo rod lined with brass, aluminum or iron. The most convenient length is about 8 to 10 feet. The bamboo rod is usually most satisfactory because it furnishes a better hand grip and it is much lighter to handle. The extension rod enables the spray man to reach the upper and inner parts of the trees without difficulty.

Spray nozzles.—The angle disk type of nozzles is the most satisfactory and efficient for most kinds of spraying work. The larger type is more suitable for the power outfits, while the smaller type is more satisfactory for the barrel pump or tank pump. Two nozzles may be attached by means of a Y to one rod if the spraying outfit has sufficient capacity and pressure. The Y's are made straight for angle nozzles or curved to a 45 degree angle for straight nozzles. All power sprayers and practically all barrel-pump and tank-pump outfits will develop enough pressure for two nozzles, and in most cases the orchardist will save time and do better work by using the Y and two nozzles on each rod. It is important that the nozzles set on the spray rod at an angle of about 45 degrees. This allows the spray man to spray upward or downward

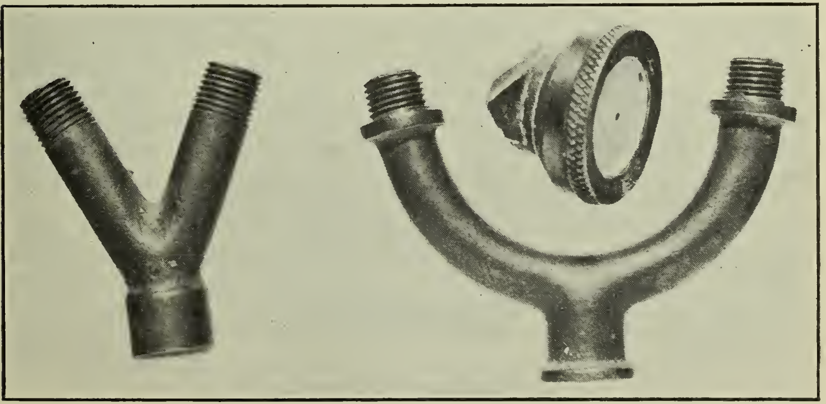

Fig. 11.—Two types of Y-nozzle connections and a good angle

with much less difficulty. The angle may be secured by using angle nozzles or by attaching straight nozzles to a crooked Y.

Miscellaneous supplies.—Heavy hose couplings and clamps should be on hand and ready for use. A good pair of scales is required for weighing the spraying materials since guess work may give poor results or it may do more injury than good. Every spraying outfit should be supplied with a good brass strainer to prevent nozzle trouble. Extra parts of equipment most liable to wear or breakage should always be on hand. Wrenches, hammers, screw drivers, etc., should always be carried in the tool box.

Spray guns.—This new spraying equipment is now being used successfully by many Missouri apple growers. The spray gun consists of a large capacity nozzle attached to a short rod. The construction of the gun is such that the spraying solution passing thru the rod may be varied from a wide angle, short distance spray adapted for use on low trees or branches, to a narrow angle, long distance spray which will reach the tops of tall trees. One may, therefore, spray at close range on lower branches and by raising the gun toward the tree tops, the spray may be changed by the movement of the spray controller.

High pressure is required for the successful use of the spray gun. It is therefore adapted for use only on power sprayers capable of furnishing a high continuous pressure. In practically all cases one spray gun is sufficient for one power outfit Spray hose of about one-half inch diameter and not over 30 feet in length generally gives best results.

With sufficient pressure and when the spray gun is properly handled one man can do as much spraying as two men with the ordinary spray rods, and the spray should be equally as thoro and effective in preventing injury to the fruit or foliage by insects or fungous diseases. Inefficient spray men are, however, more apt to do poor work or burn the fruit and foliage by over spraying in using the spray gun than in using the spray rod. The principal argument for the use of the spray gun is to save time. In spraying high trees, the spray tower is not required if the spray gun is used. Many commercial fruit growers who have become acquainted with the spray gun and its use, make the statement that it would be folly to use the spray rods longer and that their spray men prefer to use the guns. They also maintain that the cost of labor in spraying is greatly reduced. It is admitted by all, however, that the spray gun requires a superior type of equipment. A spraying pressure of from 200 to 275 pounds with two guns is unsatisfactory, while a pressure of 275 to 300 pounds with one gun should be a success. The spray gun demonstrates the need of a higher powdered sprayer with a liberal reserve pressure if possible.

PRACTICAL HINTS TO REMEMBER IN SPRAYING APPLE TREES

1. Weigh or measure accurately all spraying materials and use them according to directions. If it is desired to experiment, do it in a small way and remember that at least three or four seasons' results should be secured before the practice is adopted for the whole orchard.

2. Apply the sprays at as nearly the proper time as possible and remember that the leaves and fruits are not protected unless they have been thoroly covered with the spray. Unsatisfactory results are more often due to poor spraying than to other factors.

3. Apply the spraying mixtures as soon as possible after they are diluted

and mixed for use. If any of this spraying solution is left in the spray barrel or tank after the work is finished, pour it out or use it in respraying a few trees. It is not advisable to keep the diluted and mixed spraying solution until time for the next application. Chemical changes may occur in the lime-sulphur arsenate of lead or bordeaux arsenate of lead solution after standing for a time and if applied to apple trees it may russet or burn the fruit and foliage badly.

4. Use the standard spraying mixtures until you are convinced either by your own observation or by the observations and experiments of the College of Agriculture that the new materials are equally as good or better than the old.

5. Know when to spray, what to use, how to apply the spray to the best advantages, and what insects and diseases it is necessary to control.

6. Before the spraying season begins secure enough spraying materials for at least two applications. This is necessary because there is only about seven to ten days' time between the first and second summer sprays. Delays in ordering spray materials may mean the loss of a fruit crop.

7. Spraying materials if properly mixed, diluted and applied seldom do material injury to the leaves or fruit. Where injury is observed, however, study it carefully and be sure that the spray mixture is at fault before making radical changes in the spraying solution. Frost injury, fire blight, black rot and other factors that may do harm are often mistaken for spray-burn injury.

8. Use spraying equipment capable of doing the work required. Needed spraying accessories, such as better nozzles, spray rods and hose may mean the success or failure of the spraying work.

9. The practice of employing someone to spray the orchard often results in considerable expense and unsatisfactory fruit. It is usually advisable to spray your own orchard or lease it upon a share or cash basis.

10. Clean the spray tank or barrel, hose, rods and nozzles after each spraying by pumping clean water thru them. Detach or oil the metal parts of the outfit which are apt to be difficult to adjust or remove as a result of the action of the spray.

11. To prevent injury to the face and hands from contact with the spraying solution, smear a heavy coat of vaseline on the face, wear a slouched hat and a pair of mule-skin gloves which should be kept thoroly coated with axle grease.

12. In applying the third, fourth and later summer sprays, if the weather is hot and bright the lime-sulphur solution may burn the fruit. Under such conditions bordeaux 3-4-50 and arsenate of lead is recommended. It is also true that bordeaux is more apt to burn during cloudy, cool weather than lime-sulphur.

13. The recommendations made in this publication are adapted as far as possible to the general conditions prevailing in the fruit-growing sections of Missouri. Every fruit-grower should study carefully, however, the conditions in his own orchard, including the insect pests and plant diseases, in order to be able to work out a spraying program best adapted to his own particular needs.

THE AGRICULTURAL EXTENSION SERVICE

The Agricultural Extension Service, as far as its facilities will allow, will help any community in any of the following problems:

Agricultural Engineering.—Plans for farm buildings, construction of terraces and soil saving dams, drainage problems, tractor problems, water systems, sewage disposal systems and other labor saving devices for farm homes.

Animal Husbandry.—Feeding problems with all livestock; improvement of herds thru securing better sires; control of animal diseases.

Entomology.—The control of injurious insects.

Field Crops.—Production of pure seed; securing pure seed; control of grain diseases; introduction of new crops; cultural practices with all field crops.

Home Economics.—All problems which deal with the more efficient, healthful and economical administration of farm homes, such as child feeding, meal planning, household conveniences, kitchen arrangements, clothing, millinery, etc.

Horticulture.—Control of fungous diseases and insects affecting fruits, melons, and potatoes. Aid in setting out new orchards, in truck garden problems and in home garden problems.

Marketing.—Assistance in organization of livestock shippers' associations, cooperative elevators, and other phases of cooperative marketing.

Poultry.—Assistance in housing, feeding, breeding, and flock management problems.

Soils.—Assistance in determination of amount of limestone needed by your soil, fertilizer problems, organization of lime crusher associations, crop rotation methods of controlling soil washing and other losses in fertility.

Boys' and Girls' Club Work.—Assistance will be given in the organization of corn, canning, poultry, pig, calf, sheep, baking and sewing clubs.

For further information write the Agricultural Extension Service, Columbia, Mo.

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CO-OPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS

University of Missouri College of Agriculture and the United States
Department of Agriculture Cooperating
P. H. Ross, Acting Director Agricultural Extension Service
Distributed in furtherance of the Acts of Congress of May 8, and June 30, 1914

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Selected Apple Recipes

Essie M. Heyle

The apple is a food, not a luxury, and should be used daily and in larger quantities because of its wholesome properties.

When certain varieties are preferred for canning in quantity it is always advisable to use varieties best suited for that purpose, and at a time when they are most plentiful and the cheapest, which will normally be when that variety is being harvested in each locality.

Jonathan, Grimes and Maiden Blush are among the few varieties that are splendid for sauce, pie, jelly, marmalade, and dumpling uses; the variety of apple which makes a good sauce does not necessarily rank equally high for other methods of cooking. Ordinarily each variety is best suited for certain purposes and each housewife knows the individual tastes of the family.

Generally speaking, the size of the fruit makes very little difference in the coooking quality of apples for sauce; fruits that are at their prime or even a little over-ripe are apparently best for sauce.

The apple is more easily digested when cooked, but it is not difficult of digestion, and is most delicious raw. Whether fresh, dried, evaporated, or canned. the apple is a wholesome food, easily prepared, attractive and palatable at all times.

Use more apples.

Apples and Spareribs

Surround spareribs in pan with pared, cored apples and bake.

Fried Apples with Sausage or Pork Chops

Core firm apples and slice across in ¼ in. slices. When sausages or pork are partially cooked, add the sliced apples, turning each slice carefully until it is tender and well-browned. Serve as a garnish for the meat. This method of cooking improves the flavor both of the meat and of the apples.

Apple Dressing for Poultry

Crumble two cups of bread into small bits, soften with ½ c. luke warm water or with stock from the fowl. Add one chopped onion, two sour apples, chopped, ¼ cup diced celery or a little celery salt, two tablespoons of butter or poultry fat, and salt and pepper to taste.

Salmon or Chicken Salad

1 can salmon or 1½ cups chicken. ¼ c. nuts.
½ c. diced celery. 2 chopped apples.

Mix with salad dressing and garnish with lettuce.

Fried Apples with Sorghum Molasses

Core and slice apples across in ¼ in. slices. Fry in a small amount of bacon fat or butter. When nearly done, add 3 tb. sorghum molasses to each 6 apples used and let apples brown well in the sirup.

Gingered Apples

6 apples
¼ c. sugar
½ c. water
1 tb. chopped, candied ginger

Core apples and place in baking dish. Mix sugar, water and ginger, pour over the apples and bake until tender.

Jellied Apples

Pare and core small firm apples. Make a syrup of 2 c. sugar and 2 c. water, colored with red fruit coloring or red cinnamon drops. Drop in the apples and simmer until they are transparent. Remove carefully from the syrup, place in individual dishes and pour the sirup around them. When cold, the sirup will jelly. Serve with whipped cream as a dessert, or use as a garnish for roast fowl or roast pork.

Porcupine apples are prepared as above, without the coloring. When tender, remove, boil down sirup until thick and roll apples in it. Insert blanched almonds in the outside of apples and fill the center with jelly.

Apple and Cheese Salad

Choose small mellow apples with a tart flavor, core, bake and chill. Fill the center with cream cheese, softened with a little cream and mixed with chopped nuts. Serve with salad dressing.

Cabbage and Apple Salad

1 c. shredded cabbage
1 chopped sweet pepper
1 small onion, chopped
1 c. apple, chopped.

Select a red apple and chop without paring, combine with the other ingredients and mix with salad dressing. If desired, ¼ c. nuts may be added.

Bread Crumb and Apple Sauce Pudding

3 c. bread crumbs
3 c. apple sauce
½ c. sugar
½ ts. cinnamon

Mix sugar, apple sauce and cinnamon. Into a buttered baking dish put a layer of bread crumbs, then a layer of apple sauce, making three layers of each. Sprinkle a few bread crumbs over the top, dot with bits of butter and bake for 20 minutes.

Apple Celery Peanut Salad

2 c. chopped apples
1 c. diced celery
1 tb. peanut butter
5 tb. lemon juice.

Thin the peanut butter with the lemon juice. add salt and pepper to taste and mix with the apples and celery.

Fancy Baked Apples

Core apples, and pare or not, as desired. Fill centers with any of the following:

a. Brown sugar and butter, creamed.
b. Chopped dried figs.
c. Raisins.
d. Jelly.
e. Strawberry jam.
f. Chopped nuts and sugar.
g. Maple sugar and butter.

Pour around the apples 1 c. water in which has been dissolved ¼ c. sugar. Bake in a moderate oven until the apples are tender. A spoonful of meringue or a marshmallow may be placed on each apple and browned. Serve hot or cold, with or without plain or whipped cream.

Mince Meat

4 lbs. lean beef (heart or neck) boiled tender and chopped fine.
4 lbs. chopped apples
1 lb. suet
1 lb. each currants and raisins
¼ lb. citron
1 tb. salt
1 lb. brown sugar
2 qts. cider
1 tb. cloves
1 tb. allspice
1 grated nutmeg

Dissolve the sugar in the cider, add remaining ingredients and boil until thick and the apples are well done. When pies are made, an additional amount of freshly chopped apples or canned, spiced apples may be added.

Apple Chutney

1 qt. tart apples
1 c. raisins
2 onions, chopped
2 red peppers, chopped
½ c. vinegar
1 c. water
½ cup sugar
1 tb. white mustard seed
1 ts. celery seed
1 ts. salt.

Simmer the ingredients until the mixture is thick and clear. Seal in hot sterilized jars.

Marmalade

Run 4 c. apples and 2 c. raisins thru the food chopper, add 2 c. water, ¾ c. sugar and juice of ½ lemon. Cook until thick.

Apple Sauce Fruit Cake

1 c. brown sugar
½ c. butter or substitute
½ ts. cloves
½ ts. cinnamon
½ c. raisins
1 c. apple sauce
1 ts. soda
2 c. flour

Cream, butter and sugar, add apple sauce, then flour sifted with the soda and spices. Add raisins last, dredged with a little of the flour. Bake in a greased pan 45 minutes.

Candied Apples

Use 1 pound firm apples that will hold their shape when cooked. Pare and cut into small uniform pieces. Cook until transparent in a sirup made from 1 c. sugar and ¾ c. water. Take pieces out carefully with a fork, drain and let stand on waxed paper to dry for several hours. Roll in finely chopped cocoanut and use as a confection.

Apples and Rice

Pare and core apples, place in a baking dish and fill the centers with chopped raisins and sugar. Fill the space between apples with cooked rice. Cover and bake for 15 minutes, then uncover and bake for 15 minutes longer. Serve hot with cream.

Sliced Apple Pie With Cheese

Make apple pie as usual, but just before adding upper crust grate into the pie ¼ c. of cheese.

Apple Honey Pudding

2 apples pared and sliced thinly
½ c. chopped raisins or dates
¼ c. nuts
1 ts. cinnamon
1 egg
1 c. milk
2 tb. honey
¼ ts. salt

Cover bottom of greased baking dish with the raisins (or dates) and nuts, then the sliced apples. Add a mixture of beaten egg, milk, honey, salt and cinnamon. Sprinkle with crumbs and bake until apples are tender.

Dutch Apple Cake

Mix 1 c. scalded milk, ⅓ c. butter, ⅓ c. sugar and ½ ts. salt. When lukewarm add 1 yeast cake, broken into small pieces, 2 unbeaten eggs and flour to make soft dough; beat thoroughly, cover and let rise until the mixture has doubled its bulk. Beat and let rise again. Spread thinly in a well greased pan, brush over with melted butter and press sliced apples into the dough in even rows close together. Sprinkle with ¼ c. sugar mixed with ½ ts. cinnamon, and with 2 tb. well washed currants. Cover and let rise; bake 30 min. in a moderate oven. Cut in squares and serve plain or with cream.

Apple Butter

Use equal quantities of sweet cider and peeled and sliced apples. Boil down the cider to one-half the quantity, then add the sliced apples, a few at a time. If the apples are of a coarse texture, they chould be cooked and put thru a sieve before adding to the cider. Cook slowly, stirring constantly, until the cider and apples do not separate. When the apple butter is about two-thirds done, add a pound of sugar and ½ ts. each of ground cinnamon, cloves and allspice to each gallon of apple butter. Seal in hot sterilized jars.

Apple Snow

Two egg whites beaten stiff, ½ c. hot apple sauce, nutmeg or lemon. Fold the apple sauce into the egg whites, flavor to taste, chill and serve.

Apple Paste

To 1 lb. of well-evaporated apple pulp add ¾ lb. sugar and cook over a low fire or in the top of a double boiler until quite thick. If desired, one or more of the following may be cooked with the pulp; chopped nut meats, crystalized orange peel, preserved watermelon rind or citron, figs or raisins. Flavor with vanilla, lemon or peppermint. Pour ½ in. layers of the cooked rather solid pulp on platters which have been slightly greased. Dry in a draft for several days, cut into pieces, dry for another hour and store in glass jars or in tin boxes with oiled paper between layers. Apple paste is a good substitute for candy and makes an attractive addition to the school children's lunch box.

Apples with Oatmeal

Cook pared cored apples in sirup made in the proportion of 1 c. of sugar to 1 c. of water. Place cooked oatmeal in the cavity and on the apple and serve with cream. Oatmeat may also be served with baked apples and other cereals than oatmeal may be used.

Apple Custard

2 c. apple sauce	4 eggs
2 c. sweet milk	⅓ c. sugar

Beat the yolks, add milk, sugar and apple sauce. Fold in the beaten whites of egg, grate a little nutmeg over the top and bake in a slow oven.

Apple Meringue

2 cups of steamed apple pulp mixed with ½ c. sugar or 2 c. apple sauce, 1 ts. butter, ½ ts. cinnamon or nutmeg, yolks of 2 eggs, slightly beaten and 1 tb. cream. Put into a deep pie pan lined with crust and bake. Cover with a meringue made of the whites of the eggs and 2 tb. sugar.

Brown Betty or Scalloped Apples

Pare and cut up apples. Place layer of apples in a well buttered baking dish, then a layer of bread crumbs, sprinkle with brown sugar and cinnamon and dot with bits of butter. Repeat until the dish is full. Add warm water until it comes abouthalf way up on the pan and bake in a moderate oven until brown. Serve with hard sauce or cream. Brown Betty may be sweetened with molasses or may be flavored with lemon juice and rind.

Apple Conserve

2 lbs. sugar	8 large apples
1 pint water	2 oranges

Boil sugar and water 5 minutes. Add pared cored apples which have been cut into eighths. Cover and boil about one-half hour, being careful the sirup does not caramelize. Add oranges which have been divided into sections and cook 10 or 15 minutes longer.

Abbreviations Used:

c. Cup. tb. Tablespoon. ts. Teaspoon

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS

University of Missouri College of Agriculture, Agricultural Extension
Service and the United States Department of Agriculture Cooperating

P. H. Ross, Acting Director Agricultural Extension Service

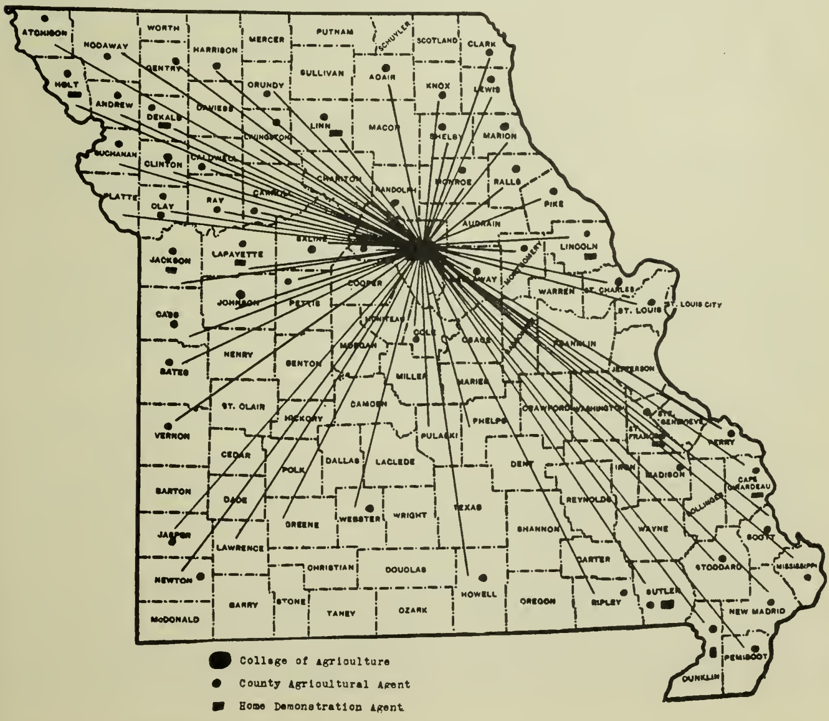
Distributed in furtherance of the Acts of Congress of May 8, and June 30, 1914

CIRCULAR 94 COLUMBIA, MISSOURI DECEMBER, 1920

How the College of Agriculture Serves Missouri Farmers Thru the Agricultural Extension Service

P. H. Ross

Do you know that the College of Agriculture of the University of Missouri is in a position to carry its work to your door, and that every year its representatives visit practically every county in the state? That more than half the counties retain one or more College



representatives permanently in the county? That thru the Agricultural Extension Service every department of the College can be of direct help to you?

When you think that there are 263,000 farms in Missouri, you immediately realize that it is physically impossible for the College to be of direct individual help to every farmer. A great many farmers are not yet in the habit of making use of the College; a great many others are met in groups, but comparatively few as individuals. A total of 483,907 persons were thus reached in meetings addressed by Agricultural Extension Service representatives last year.

The County Agent System—These results have been made possible thru the county agent system. The county agent is a representative of the College, located permanently in the county and within a few hours drive of any farm within its borders. He represents the College among the farmers and represents the farmers at the College. A portion of his salary is paid from each of these sources,—an arrangement that has proved its effectiveness and has secured the endorsement of Missouri farmers. Sixty-one counties now have agents or have made complete arrangements for their employment.

Home Demonstration Agents.—The home demonstration agent occupies a position similar to that of the county agricultural agent, her work being to assist for the most part with farm home problems. Eighteen. counties of the state have made complete arrangements for the employment of these agents.

EXTENSION SPECIALISTS

In addition to its county extension agents, the Extension Service maintains a corps of specialists, each thoroly trained in his special line.

Boys' and Girls' Clubs.—This work is carried on by four workers —two men and two women. Last year over 20,000 members were enrolled in clubs and were given instruction in one or more of the following: Corn raising, garden work, canning fruits and vegetables, poultry, pig, calf and sheep raising, baking and sewing.

The aim in this work is not only to give instruction in farm methods and operations, but to develop the spirit of cooperation and to give practice in participation in public affairs. Every community should have an agricultural program in which boys' and girls' club work occupies a prominent part.

Agricultural Engineering.—Our agricultural engineer aids in prevention of soil washing by supervising the construction of terraces and soil saving dams; helps in drainage and tractor problems, gives definite information on the installation of water systems, and other labor-saving devices for farm homes; furnishes blueprints and gives other assistance in the erection of farm buildings.

Animal Husbandry. — Three Extension men are employed at present in this work. One has charge of extension work with sheep and has worked not only with feeding, breeding, and other sheep management demonstrations, but has given special assistance in wool pooling. Over a million pounds of wool were pooled last spring under the direct supervision of the county agent and sheep specialist. Special assistance has been given the control of diseases and pests.

Another specialist gives his full time to cattle problems and will feature during the coming year the "Better Bulls Campaign." He also helps with feeding problems and in the selection of better sires in all classes of live stock.

The third specialist has been giving his time almost exclusively to hog feeding demonstrations, and is in a position to be of service to farmers by demonstrating in their own feed lots that methods of feeding as developed at the Missouri Experiment Station, produce pork at the lowest possible cost.

Dairy Husbandry.—Two specialists give their time to dairy work. Special aid has been given many communities in organizing cow test associations and Better Bull associations. Help in feeding, breeding and dairy management is available to all Missouri farmers. Particular attention will be given the Better Bull campaign.

Entomology.—Insects cost the farmers of Missouri an average of ten million dollars annually—a loss that is preventable by known methods of control. One specialist gives his whole time to the insect control problem and is available to the farmers anywhere in the state insofar as his time will permit.

Field Crops.—Our budget allows for three men to handle demands for help from farmers in this line. Since all the help cannot be given that is demanded the work is confined to its most important phases. Locating sources of high grade seed, control of grain diseases, introduction of valuable new crops, special assistance to Smith-Hughes teachers in their crop projects, occupy the major portion of the specialists' time.

Home Economics.—The home economics section of the AgriculturalExtension Service is particularly interested in cooperating with women in solving those of their problems which deal with the more efficient, healthful and economical administration of their homes. The five women in this section give demonstrations in efficient household processes and talk on such subjects as: Feeding Children, Meal Planning, Special and Corrective Diets, Value and use of Milk, Keeping

Physically Fit, Care of the Body, Care of Infants, Appropriate, Becoming Clothes; Choosing Household and Clothing Materials; Kitchen Arrangements, Household Conveniences, Household Accounting.

Horticulture.—Missouri's horticultural interests constitute one of the most important industries in the state. One specialist for the last several years has been demonstrating successfully in Missouri orchards the great profit in properly pruning and spraying apple orchards. Demonstrations in the control of melon diseases and insects have been an important phase of the work during the last year. Growers of small fruit and truck crops will be served upon request.

Marketing.—Livestock shipping associations have been organized in many counties and help in this activity is available to all communities. Assistance can also be given in the organization of cooperative elevator companies. Suggestions and advice on all forms of farmers' cooperative marketing is always available.

Poultry.—With very few exceptions, every Missouri farm has a flock of chickens. Thousands of farmers have been given assistance in poultry culling and the help is still available to those who desire it. Direct assistance in housing, feeding, breeding, and flock management will be given to all requests insofar as time allows the two specialists in this work.

Soils.—Do you know whether your soil is sour? We will be glad to help you get the information. Is limestone for agricultural purposes available in your community? We will help you in ascertaining its value by giving it a test and will help organize in such communities as desire it, a cooperative association for the purchase and operation of a lime crusher. Help is given in the selection of the most profitable commercial fertilizer, where it is determined that fertilizer can be profitably used.

The Farm Bureau.—The greater portion of the extension work is done in cooperation with county farm bureaus. These organizations pay a portion of the salaries of our extension agents and all of their local expenses. They assist in planning the agricultural program for the county and in hundreds of communities there are local men and women giving their time, thought and money to help to make extension work successful, because they realize its worth to their community.

If you believe the College of Agriculture can be of service to your community in any way in addition to what it is now doing, see your county agent or write the Agricultural Extension Service, College of Agriculture, Columbia, Missouri.

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE AND THE UNITED STATES
DEPARTMENT OF AGRICULTURE COOPERATING

P. H. Ross, Acting Director Agricultural Extension Service

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CIRCULAR 95 COLUMBIA, MISSOURI OCTOBER, 1920

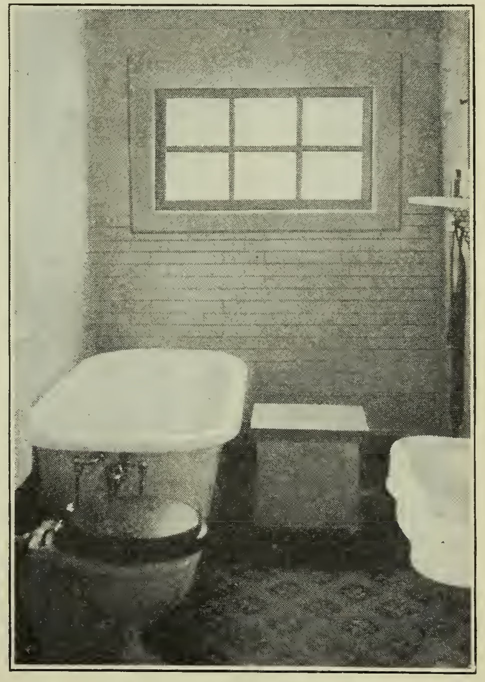
The Modern Rural Home in Missouri

Essie M. Heyle

Missouri has comparatively few modern rural homes. In some progressive country communities there may be as many as one-tenth of the homes that are modern, but in many communities there are none at all. At least one out of every four farmers could well afford to install some of the modern home conveniences. Why, then, are so many Missouri farm homes lacking in these conveniences, especially in modern methods of supplying the home with heat, light and water? Perhaps the principal reasons are these:

1. Many thrifty Missouri farmers feel that they cannot afford modern conveniences in the home because they believe that money spent in this way is not a paying investment.

2. Missouri farmers and their wives have been slow to realize how much modern home conveniences would mean to themselves and to their children in comfort, health and contentment with farm life, and have been too conservative to want what they have never had.



A rural home bathroom which W. T. Reed of Montgomery County installed

Money Spent for Modern Home Conveniences Is A Good Investment

Most Missouri farmers and their families are thrifty and economical. They work hard and willingly deny themselves many of the comforts and pleasures of life in order to get ahead more rapidly. They put most of their profits back into the farm and borrow money to invest in more land, better farm equipment and finer stock, so that they can make more money. But it is not always the best thrift and wisest economy to put most of the profits back into the business of farming just to make more money. Life that amounts to anything at all must provide sufficient leisure for real living, for enjoyment with one's family and friends, for reading and music and for those things which build up and improve the community. Life should not be so filled with unnecessary hard work that the members of the family have no time or strength for anything beyond the mere making of a living. Even when the price of land is high, many farmers persist in buying more land and by bidding against each other to obtain it, increase the price still further. This has resulted, in many cases, in such high-priced land that the production will not pay interest on the investment and provide a reasonable profit. It would be better business for such farmers to be content with less land and to put more money into modern home conveniences that would make living more worth while.

Money spent in making the home modern is not a nonproductive investment, but is a proposition which pays in dollars and cents. A modern home will pay for itself financially in the following ways:

1. More money can be made by the farm woman from her poultry, bees, gardening or dairy business because she will have more time in which to improve and enlarge it. She may also read bulletins or attend meetings where she will learn how to increase her profits.

2. If a water system is installed in the house, it can be extended to supply water wherever it is needed on the farm. Running water at the barn means better livestock, cleaner barns and time saved for the farmer, all bringing greater financial returns. Water, under pressure, supplied to the garden may save enough vegetables in time of drought to pay the interest on the money invested in the water system. The possibility of having sufficient water always at hand to fight fire among the farm buildings should appeal to every farmer as a good form of insurance and in time of such an emergency a good water system may save its cost many times over.

3. When modern conveniences are installed, the health of those living on the farm is so improved and maintained that not so much money is spent for medicine or doctor's bills. Fatigue and constipation are the two greatest causes of the lowered vitality which precedes every case of illness; in a modern home these are greatly reduced. The resistance of the body to disease is increased by the frequent baths possible when a bathroom is installed, by the purer air in rooms lighted by electric lights instead of lamps, by the abundance of fresh air which is more likely to be found in a furnace-heated house where windows may be opened at night and for frequent airings in thse daytime with the assurance that the furnace will quickly heat the rooms again. The modern home may also

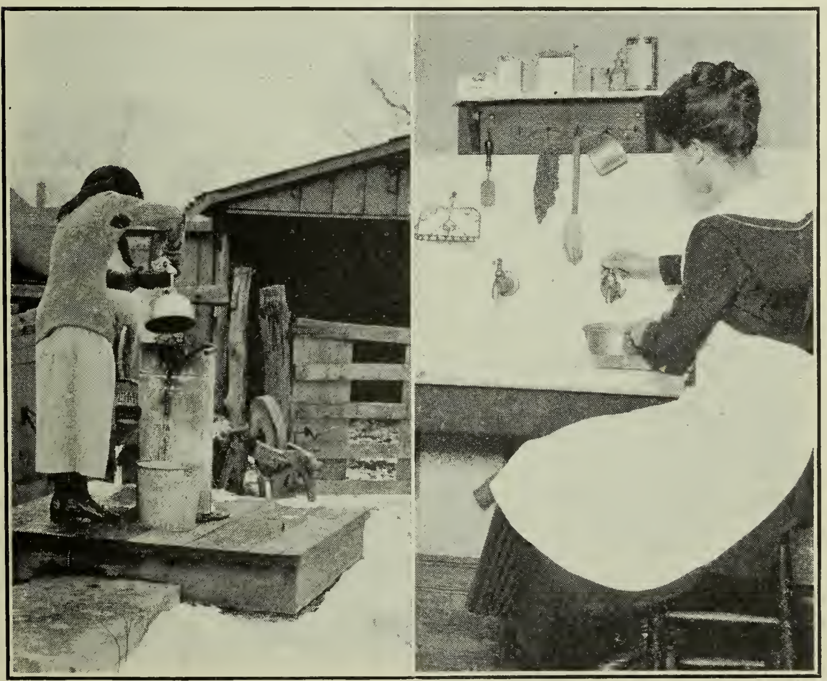
save doctor's bills because where there is a safe waste disposal system instead of an old-fashioned privy there is much less danger of such diseases as typhoid and dysentery. (Read "The Modern Rural Home and Health," published by the Agricultural Extension Service of the University of Missouri College of Agriculture.)

4. A modern home saves unnecessary fatigue and thus increases the efficiency and earning power of farmers and their wives. It has been estimated that the fatigue caused by the unnecessary work involved in carrying water, cleaning and filling lamps and tending several stoves instead of one furnace, results in a lack of efficiency equal to an actual money loss of at least sixty dollars on any farm in a year. In other words, this is the minimum sum which might be saved if the farmer and his wife were not too tired to learn improved methods of doing things on the farm from county agents, bulletins, farm papers, etc.

5. A modern home prolongs the lives and thus the working period and total earnings of farm men and women.

How a Few Missouri Farm Women Feel About Their Modern Homes

Mrs. Allen Soper, Slater. "I would not willingly do without the modern conveniences we have. While they may not always return the exact cost price in actual dollars and cents, they do save money by saving



Which of these two women will live longer, get the greatest joy out of living and do more for her family and community?

time, the expense of extra help and the health of the users. They are decidedly worth their cost."

Mrs. R. T. Pence, Marshall. "Modern conveniences are worth while in a country home. As to the initial cost, that should not be considered if one is able to have them. Anything that saves a woman's strength and time, as does running water in the home, cannot be measured with dollars and cents. We find a heating plant for the whole house much more economical than several stoves from the fuel standpoint, to say nothing of time and strength saved in caring for one stove instead of several. When all of the family and the cook were down with the "flu" and Mr. Pence the only nurse, he said 'That bath room is worth one hundred dollars a day.' "

Mrs. John Denton, Buckner. "If farmers could realize the pleasure they could get from barn lights, they would not think that the lighting system only benefitted the women. The other night we had three trucks come and load with hogs for market. The hogs were very contrary and the light made the yard like day and saved a lot of extra work gathering up the ones which were trying to get away. It also makes it possible to milk before daylight while the nights are so long; then also the basement has proved an ideal workshop for the men. My husband has put in a vise and workbench and sharpens his saws or does any work on that order in comfort with always a good light and enough heat for bare-handed work, where before he had to wait for warm days."

Mrs. R. J. Guyer, Linneus. "Furnace and electricity for power and lights on the farm save so much time and hard work that they give the farm people time for recreation and pleasure."

Mrs. M. B. Harter, Meadville. "Our home conveniences have been the best investment we have made in many years. One cannot appreciate a water system in the home until he has it. The question with the average farmers is not whether he can afford these conveniences, but rather if he can afford not to have them."

Mrs. A. M. Walker, Laclede. "We added our conveniences when we remodeled our house but we consider the money well spent. Our family has been in much better health since we have the conveniences and I really could not do without them for I have not the strength."

Mrs. Frank Clayton, Miami. "I could not do without the water in the home even though its cost were twice the amount. Every man renting a farm should equip it with substantial modern improvements and charge more for his rent, just as they do in town, and let the production pay the bill. It is the only safe way because there will be more people on the farm and more conveniences to make unnecessary work. This will result in fifty per cent more stock, chickens, cream, butter and everything else that is produced on the farm. Everybody should have a sleeping porch of some kind in the hot weather for the benefit of their health. There is nothing like it, not even at a summer resort, and it certainly pays."

Mrs. Emma J. Bridges, Slater. "We could not do without the electricity which is furnished by 15 storage batteries. These are charged by the engine that pumps the water for the stock and the house and it does not cost any more than the same amount of light which is furnished by oil lamps. We do not see how anybody who can at all afford home conveniences is content to get along without them and we believe they do pay."

Modern Farm Homes Increase Comfort and Efficiency in Communities.

Those who have not had running water in the house, a furnace, bathroom, electric lights, etc., are likely to regard such improvements as unnecessary luxuries. Equipment for living which adds to the comfort, happiness and health of individuals, and hence makes men and women more efficient, is not a luxury, but is as necessary as is farm equipment.

Modern rural homes make country life more attractive. When a farmer installs water, lighting and heating systems he sets an example that is reasonably sure of being followed by other farmers in his neighborhood. As a result, he and the other farmers who are usually the most intelligent men and progressive farmers in the community will, in most cases,

This woman and all others who live in houses without water systems lift about a ton of water a day. Isn't farm women's work hard enough without putting this unnecessary burden upon them?

stay on the farm when they can live in a house as comfortably equipped as any town house. Their children will also stay and as a result there will be more progressive farming, a more satisfactory social life and a more progressive community. Many intelligent men who are able to make a good living in town, but who really prefer farm life, do not stay on the farm because their wives cannot stand the strain of the hard work in houses without the conveniences of town houses, and many substantial farmers who have made money on the farm move to town after middle life so "Mother" can have an easier life.

Modern Rural Homes Add Contentment Too, Say Missouri Farm Women.

Mrs. Charles Palmer, Montgomery City. "Our modern home has added much to the health, happiness and comfort of our family. I believe that modern homes and the automobile are aiding in keeping young people on the farm."

Mrs. R. H. Scott, Nelson. "I certainly would not, under any circumstances, do without the modern conveniences we have in our home. To me the country woman's home means much more to her than the town woman's home as she does not have the social and many other advantages that towns afford, and certainly modern conveniences do most toward making a home pleasant in the country. In fact, you can see very few of the young people whose country homes are attractive leaving the farm, but usually the ones who have had no conveniences and think they can have them only by going to town. I believe it is the secret of keeping the children on the farm, a question that all country parents are interested in."

Mrs. A. D. Platner, Malta Bend. "Our modern conveniences have paid for themselves many times over. I simply couldn't live on the farm if I didn't have them. I am not speaking lightly when I say that. My health isn't very good and I simply could not. If there were more modern homes in the country, there wouldn't be so many women wanting to move to town and the doctor would have less to do also."

Mrs. M. L. Hall, Montgomery City. "We have had a furnace, water pressure system and acetylene lights for ten years and not a day passes but what I am thankful for them and wonder how so many do without them. While each convenience adds its share to the comfort and health of the family, the water system is the greatest of all labor-saving devices and is the one which adds vitally to the health, comfort and happiness of the family. Where we have the health, comfort and happiness which come from a modern home, both the young and the old are content to stay on the farm."

The Missouri farmer believes in progress. This is evident from the fact that in this state there is a general use of improved equipment for the farm and that practically every farmer has a telephone and many of them have automobiles. When more of our farmers have their attention called to the value of modern home conveniences, these conveniences will be installed, and "living on the farm" will take on a new and brighter meaning.

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE

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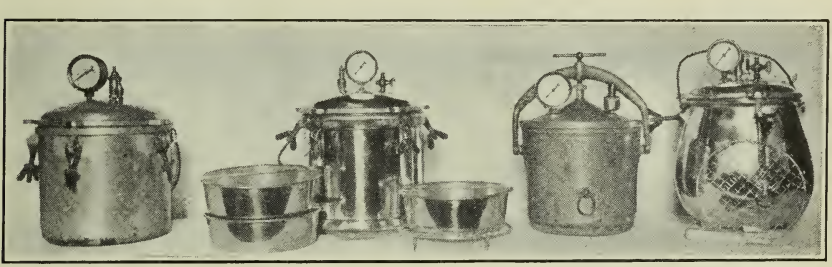
CIRCULAR 96 COLUMBIA, MISSOURI DECEMBER, 1920

Steam Pressure Cooking

Anna C. Jensen

Cooking by means of steam pressure has long been used commercially in institutions and on battleships, but only within the last few years have pressure cookers been made for the household. There are several types made, varying somewhat in shape and ranging in size from eight to fourteen quarts, but all operate on the same principle.



A pressure cooker is an aluminum kettle made with such a tightly fitting cover that no steam from the cooking food can escape. In such a cooker pressure is produced and the temperature is raised above the boiling point. As the temperature is increased the time required for cooking foods is decreased. For example, dried navy beans can be cooked in thirty-five minutes at fifteen pounds steam pressure, whereas it takes several hours of boiling or baking by the ordinary method.

SOME OF THE ADVANTAGES OF PRESSURE COOKING

1. Pressure cooking saves time, labor and fuel.
2. Foods cooked in pressure cookers cannot boil dry and burn. Such foods as cereals and starchy puddings should always be cooked in an inner vessel. If cooked directly on the bottom of the kettle they may stick and brown.
3. There is little loss of flavor or juices, and no blending of flavors, if several foods are cooked at once.

stay on the farm when they can live in a house as comfortably equipped as any town house. Their children will also stay and as a result there will be more progressive farming, a more satisfactory social life and a more progressive community. Many intelligent men who are able to make a good living in town, but who really prefer farm life, do not stay on the farm because their wives cannot stand the strain of the hard work in houses without the conveniences of town houses, and many substantial farmers who have made money on the farm move to town after middle life so "Mother" can have an easier life.

Modern Rural Homes Add Contentment Too, Say Missouri Farm Women.

Mrs. Charles Palmer, Montgomery City. "Our modern home has added much to the health, happiness and comfort of our family. I believe that modern homes and the automobile are aiding in keeping young people on the farm."

Mrs. R. H. Scott, Nelson. "I certainly would not, under any circumstances, do without the modern conveniences we have in our home. To me the country woman's home means much more to her than the town woman's home as she does not have the social and many other advantages that towns afford, and certainly modern conveniences do most toward making a home pleasant in the country. In fact, you can see very few of the young people whose country homes are attractive leaving the farm, but usually the ones who have had no conveniences and think they can have them only by going to town. I believe it is the secret of keeping the children on the farm, a question that all country parents are interested in."

Mrs. A. D. Platner, Malta Bend. "Our modern conveniences have paid for themselves many times over. I simply couldn't live on the farm if I didn't have them. I am not speaking lightly when I say that. My health isn't very good and I simply could not. If there were more modern homes in the country, there wouldn't be so many women wanting to move to town and the doctor would have less to do also."

Mrs. M. L. Hall, Montgomery City. "We have had a furnace, water pressure system and acetylene lights for ten years and not a day passes but what I am thankful for them and wonder how so many do without them. While each convenience adds its share to the comfort and health of the family, the water system is the greatest of all labor-saving devices and is the one which adds vitally to the health, comfort and happiness of the family. Where we have the health, comfort and happiness which come from a modern home, both the young and the old are content to stay on the farm."

The Missouri farmer believes in progress. This is evident from the fact that in this state there is a general use of improved equipment for the farm and that practically every farmer has a telephone and many of them have automobiles. When more of our farmers have their attention called to the value of modern home conveniences, these conveniences will be installed, and "living on the farm" will take on a new and brighter meaning.

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS
UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE, AGRICULTURAL EXTENSION SERVICE AND THE UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING
P. H. Ross, Acting Director, Agricultural Extension Service
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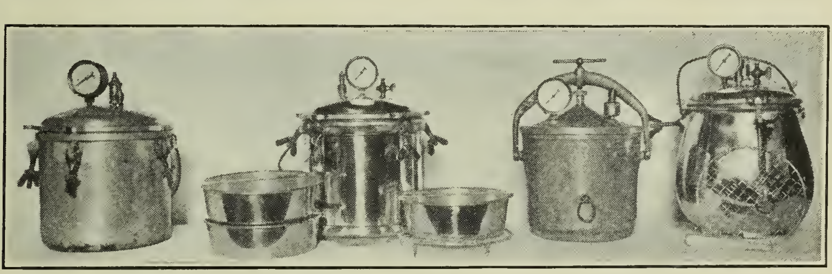
CIRCULAR 96 COLUMBIA, MISSOURI DECEMBER, 1920

Steam Pressure Cooking

Anna C. Jensen

Cooking by means of steam pressure has long been used commercially in institutions and on battleships, but only within the last few years have pressure cookers been made for the household. There are several types made, varying somewhat in shape and ranging in size from eight to fourteen quarts, but all operate on the same principle.



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2. Foods cooked in pressure cookers cannot boil dry and burn. Such foods as cereals and starchy puddings should always be cooked in an inner vessel. If cooked directly on the bottom of the kettle they may stick and brown.

3. There is little loss of flavor or juices, and no blending of flavors, if several foods are cooked at once.

4. A whole meal can be cooked at one time in one pot over one fire.

5. The pressure cooker is especially well adapted to canning vegetables or meats because two-thirds of the time of sterilization can be saved. There is also less chance of spoilage because more organisms are killed at the higher temperature used.

6. Food can be kept hot longer in the cooker. Some farm women send warm food to the harvest fields in pressure cookers.

EXPLANATION OF PARTS

Attachment on lid of cooker	Purpose	How to use
Dial or steam gauge.	Indicates pounds of pressure, degrees of temperature or both.	Watch dial until required pressure is obtained then regulate flame under cooker to maintain pressure at that point.
Safety valve	Automatically allows steam to escape before explosive pressure is developed.	Keep clean and in good working order.
Pet Cock	Allows escape of air before pressure is produced and of steam when cooking is finished.	At beginning of cooking process, open until steam can be seen coming from pet cock when air will be exhausted, then close during cooking period. At end of cooking period open after indicator reaches zero, or if in a hurry to serve food, open at once, but very slowly so as to exhaust steam gradually or juices will be drawn from food.

GENERAL DIRECTIONS FOR PRESSURE COOKING

1. Prepare foods for cooking by the usual method. Either one or several foods may be cooked at one time. If several are to be cooked, select those that require approximately the same length of time.

2. Food may be placed directly on the bottom of the kettle to cook as with meat or vegetables, laid on the rack or cooked in separate vessels set on the rack as with cereals, puddings, etc.

3. Dried foods as navy beans, lima beans, dried fruits or tapioca must be well covered with water whether cooked directly in the kettle or in containers set on the rack. Other foods require no water except the small amount—one cupful—put in the bottom of the cooker to create the necessary steam.

4. Seasonings as salt, pepper, sugar, butter or other fats are added when foods are put on to cook. Milk, cream or white sauce should not be added until after the food is removed from the cooker.

5. When meats are cooked, the liquid left in the bottom of the cooker, being a mixture of water, fat and meat juices, can be served as a thin pan-gravy with the meat. If a larger quantity of thickened gravy is desired, the meat should be well dredged in seasoned flour, seared in a little hot fat in the bottom of the kettle and two cups of water added instead of one. When the meat is done the gravy is ready to serve.

PRESSURE COOKER RECIPES

All measurements in recipes are level.

Cereals—Start cereal as for ordinary cooking in a pan that will fit in the pressure cooker. Boil three to five minutes. Put one cupful water in cooker, place pan on rack in cooker and steam 15 minutes at 15 pounds pressure.

Vegetables—Vegetables, after being prepared for cooking, can be put in the cooker with meat, laid on rack or in a vessel without water and steamed. Potatoes, carrots, turnips, onions or string beans can be cooked at 15 pounds pressure in 10 to 15 minutes. Beets or parsnips can be cooked in 15 to 25 minutes according to the size of the pieces and the age of the vegetables. The pet cock should be left partly open when cooking turnips, cabbage or other strong-juiced vegetables or the vegetable will have a very strong flavor. Dried vegetables should be well soaked and cooked 30 to 40 minutes in water.

Stew—Take 1½ pounds stew meat, 6 potatoes, 2 carrots, 2 onions, 4 tablespoonfuls rice or beans, 1 teaspoonful salt, ¼ teaspoonful pepper, 1 small turnip, 4 tomatoes or 1 cupful. Add water to cover.

Cook 30 minutes at 15 pounds pressure.

Baked Beans—Take 2 cupfuls beans washed and soaked, 1 tablespoonful dry mustard, 2 tablespoonfuls sugar or molasses and 1 tablespoonful salt. Add water to cover.

Cook 40 minutes at 15 pounds pressure then brown in the oven.

Brown Bread—Take 1 cupful cornmeal, 3 cupfuls graham flour, 2 teaspoonfuls soda, 2 cupfuls sour milk, 1 cupful molasses, ¼ cupful sugar and 1 cupful raisins.

Place in five one-pound baking powder cans, well greased, filling each can half full. Place lids on cans, place on rack and cook 40 minutes at 15 pounds pressure then remove lids and dry for a few minutes in the oven.

Suet puddings can be cooked in a pressure cooker if the same directions as those for cooking brown bread are followed.

Apple Tapioca—Take 2 cupfuls cold water, ⅓ cupful sugar, ½ cupful dried apples, peaches or apricots, 4 tablespoonfuls pearl tapioca and a pinch of salt.

Soak tapioca and fruit one hour or longer in the cold water. Add sugar and salt. Place in an inner vessel and cook 15 minutes at 15 pounds pressure. Chill and serve with cream.

Fried Chicken—Prepare old chicken as for frying, salt, roll in flour and brown in a small amount of hot fat in the cooker. Add one cupful of boiling water or 2 cupfuls if gravy is desired. Cook about 35 minutes at 15 pounds pressure, or if chicken is tough 40 to 50 minutes at 10 pounds pressure. If the chicken is preferred crisp, brown in the oven after it is taken from the cooker.

Ham—Prepare as for boiling. Add no water except the cupful in the bottom of the cooker. A ham weighing 6 to 8 pounds cooked 50 minutes at 15 pounds pressure is well done.

All meat is more juicy if steam is not exhausted.

CANNING

The method of canning in a pressure cooker is the same as that used in water bath canning, except that the time required for sterilization is much less than that required for water bath canning. The jars are placed on the rack in a pressure cooker in which two cupfuls of boiling water have already been poured. Fasten the top on the cooker, close the pet cock as soon as steam forms, but do not count time until the indicator reaches the desired pressure. Keep the temperature uniform during the required period of sterilization and **do not open the pet cock until the indicator on the dial points to zero.** For detailed direction and for time of sterilization required for different products consult the bulletin, "Canning in Glass by the Cold Pack Method" issued by the Agricultural Extension Service of the University of Missouri College of Agriculture, Columbia.

PRESSURE COOKER MEALS

I

Pot roast and potatoes
Baked beans Beets
Dried fruit

Sear the seasoned meat in a small amount of hot fat in the cooker. Pile the potatoes around the meat and add ¾ cupful boiling water. Prepare beans according to recipe above. Place beans, beets and dried fruit, which has been soaked in water, in three separate vessels on the rack. Beans and fruit should be well covered with water. Cook 40 minutes at 15 pounds pressure.

II

Mock Duck
Potatoes Onions
Apple Tapioca

Spread a bread crumb stuffing on a round or flank steak, roll and tie. Sear the meat in hot fat, pile potatoes around the meat and add ½ cupful boiling water. Place onions and apple tapioca pudding in two vessels on the rack. Cook 15 minutes at 15 pounds pressure.

III

Fried Chicken
Rice Green Beans
Prunes

Prepare chicken according to the recipe already given. Place beans, rice and prunes in separate vessels on the rack. Rice and prunes should be well covered with water. Cook 40 minutes at 15 pounds pressure.

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P. H. Ross, Acting Director, Agricultural Extension Service
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CIRCULAR 97 COLUMBIA, MISSOURI JANUARY, 1921

Meal Planning

Essie M. Heyle

Every woman who cooks for a family should know how to select the right foods in the right amounts. She should know how to prepare them properly and the ways to adapt them to the varying needs of the individuals at her table. Ways by which a woman may know she is feeding her family correctly are: If the adults maintain their normal weight, the children make satisfactory gains, and if all members are mentally and physically active and have no digestive disturbances. If, however, the children are pale, listless, irritable, underweight or show other signs of being undernourished, or if the adults are anaemic, constipated and are either over or under weight or show signs of indigestion, the housewife should immediately investigate her meals to find out what is wrong and correct it. It is probable if the above symptoms manifest themselves that she is either making a poor selection of foods for her family, or is preparing the dishes so that they are unappetizing or difficult to digest.

SELECTING THE FOOD

A balanced or correct diet must include, in the meals of each day, some foods which will build up the body and repair any worn out parts, some which will provide plenty of energy to do the day's work and some which will keep the entire system in good working order and the body growing normally. An easy way for a housekeeper to be sure that she is furnishing the kinds of food the body needs, is to see that foods from each group in the following table are served every day. In addition to this, however, she must:

(a) Serve milk or milk dishes every day, particularly when there are children in the family.

(b) Plan a varied diet, being careful not to choose for a meal or for a day's meals, too many foods from any one group. For instance, one food other than milk from group II is enough for a meal and it is quite unnecessary to serve several vegetables from group I.

(c) Provide from day to day different kinds of fresh and cooked fruits and vegetables so that the body will get the different minerals it needs. One of the following should always be served at least two or three times a week: greens, carrots, lettuce, onions, celery, asparagus, cabbage.

FOOD GROUPS

I	II	III	IV	V
Fruits and vegetables	Meat and other protein foods	Starches	Sweets	Fats
greens root vegetables lettuce, celery beans, peas cauliflower tomatoes, etc. fruit—fresh, canned or cooked dried fruit	lean meats poultry fish oysters milk cheese eggs dried beans and peas nuts	bread crackers cereal breakfast foods rice macaroni tapioca potatoes hominy	sugar syrups molasses honey preserved fruits, jams and jellies candy sweet dried fruits as raisins, dates, etc.	butter cream lard fat meats salad oils cooking oils

ADDITIONAL INFORMATION ABOUT FOODS

1. Whole milk, butter, cream, egg yolks and green vegetables, particularly the leafy ones, contain the greatest amounts of the so-called fat-soluble A vitamine of which many persons do not get enough. If some raw fruits and vegetables are eaten, there will be no danger but what enough of the other two vitamines will be obtained in the ordinary varied diet. Vitamines are absolutely necessary for growth and health.

2. Iron is needed to make good red blood. Adults and growing children, particularly adolescent girls, need an abundance of iron-rich foods. Iron is found in the greatest quantities in such vegetables as greens, cabbage, lettuce, celery, tomatoes, string beans, carrots and beets. Also large amounts are found in egg yolks, bread and cereals made from the whole grain and in such fruits as prunes, oranges, raisins, dates and lemons.

3. Growing children and adults, especially pregnant or nursing women, need foods containing lime to build strong bones and sound teeth. Such foods are milk, cheese, carrots, spinach, lettuce, green beans, turnips, oranges, rhubarb, lemons, whole cereals and nuts, but milk is by far the most valuable lime food. A quart of milk contains approximately as much lime as eleven loaves of bread, thirty pounds of beef or twenty-one pounds of potatoes.

4. Honey, molasses, cooked cabbage or onions that cause a slight formation of gas, or bulky foods, such as fruits, vegetables, breads or cereals, containing all or part of the bran coat or acid fruits help in correcting or preventing constipation.

5. More time is required to digest foods containing fat, so that when meals are planned which contain too little fat, the food passes rapidly from the stomach and a feeling of emptiness results. Fried foods, pie, pork, and

others rich in fat, require so much time to digest that digestive disturbances may result from their frequent use, particularly by young children or those who do not take sufficient exercise.

GENERAL SUGGESTIONS FOR MEAL PLANNING

1. Think of the children first. See that every meal includes easily digested and simply prepared foods suitable to their needs. Give them plenty of milk and milk dishes. Give them vegetables, fruit, eggs, bread, butter and a few simple sweets, but allow them to eat little or no meat and to drink no tea or coffee. It is also inadvisable for them to eat rich desserts and pastries. Children under twelve need from a pint and half to a quart of milk every day, either to drink or used in cooked foods. Children more than twelve years of age need at least a pint of milk a day.

2. Give your family simple meals of few dishes. Get variety by changing menus from day to day and by varying the ways of cooking, but not by serving many dishes at one meal. Simple meals mean less time spent in preparation and dishwashing, as well as less danger of overeating.

3. Begin breakfast with fruit and, when practical, the dinner with a thin savory soup as these stimulate the appetite and the flow of the digestive juices. Serve syrup, preserves, honey and other sweets at the close of the meal when there is less danger of blunting the appetite for more needed foods and causing digestive disturbances.

4. Do not serve two or more foods, difficult to digest, such as griddle cakes, pork chops, mince pie or doughnuts on the same day. Whether these should be served at all depends upon the age and health of the members of the family and upon how much exercise they take out of doors.

5. Avoid serving several starchy dishes in the same meal, such as rice, sweet and Irish potatoes and corn, or several foods rich in fat, as pork, fried potatoes and pie, or several protein foods such as meat, macaroni and cheese, navy beans and custard.

6. Plan meals so that there will not be a sameness of flavor, color, form, temperature or texture. Avoid such combinations in the same meal as potato soup and potato salad, or several dishes flavored with onions. Try to serve a moist food with a dry food or a crisp food with a soft food.

7. In summer, unless one works harder, the body needs less food. Serve few dishes and foods simply prepared and easily digested. Serve less often, or not at all, foods rich in fats, as gravy, rich cake or pie, as these retard digestion. Keep cool by eating a smaller amount of protein foods and more fruits and vegetables.

8. Many women feel that persons doing vigorous out-of-door work need a quantity of meat in the diet. Increased energy, however, requires additional fuel foods as those in Group III, IV and V, rather than more tissue-building foods as meat, etc.

9. At some seasons of the year, as in late winter or early spring, the housewife, who is at a distance from a market, cannot have a variety of foods from which to select. She must, therefore, study variety in preparing a few staple foods if she makes her meals tempting. There are more than fifty ways of preparing potatoes. Beef or pork can be prepared in at least

ten different ways. Cabbage can be made into a dozen dishes, no two alike. Apples are the foundation of fifteen or more simple but appetizing desserts or salads.

10. To insure variety and in order to keep out of a rut in cooking, the housewife should be on the alert for different dishes and for new ways of serving common foods. Consult recipe books, magazines, bulletins, circulars and other helps. A list of salads, desserts or other special dishes, which the family likes, will save time in planning meals and act as a reminder, lest some good dishes be forgottten.

MEAL PLANS

Breakfast Plan	Dinner Plan	Supper or Luncheon Plan
fruit cereal hot dish, as eggs or bacon bread butter beverage	meat or other protein dish starchy dish, as potatoes, rice or macaroni one other hot vegetable dish or a vegetable salad bread and butter beverage Dessert	one hearty dish (see following discussion) bread butter beverage dessert

Possible Variations of Breakfast Plan.—For children or adults who do no hard physical work, or for all those who enjoy eating a large serving of cereal, the hot dish may be omitted, unless the family get up early or have a light noon meal. If the men of the family do hard muscular work, they may need two hot dishes, as meat or eggs and potatoes. The beverage should invariably be milk for small children, and milk, cocoa or cereal coffee for older children.

Possible Variations of Dinner Plan.—A fruit salad may be used in place of dessert, in which case of course, no vegetable salad should be served. While the dinner, as planned, is adequate for any occasion, it may be made more elaborate by serving a thin soup first or by serving both a hot vegetable and a vegetable salad.

Possible Variations of Supper or Luncheon Plan.—The farmer or other out-of-door worker may require an extra vegetable dish for supper.

Suitable hearty dishes for supper or luncheon are cream soups, chowders, creamed dishes, macaroni or rice with cheese, baked beans, mush and milk, milk toast, cottage cheese, meat and vegetable stews, hash, meat pies, eggs, corn pudding, or a hearty salad. The usual dessert is cookies or cake with cooked fruit or a cold pudding.

Whether the meal is served at noon or in the evening, depends upon the occupation of the different members of the family. Persons who study or do other mental work during the day, need a simple easily digested lunch at noon and a heavier meal in the evening. Children sleep better after a light supper but those who carry a cold lunch to school need warm and nourishing, but easily digested food, in the evening.

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DEPARTMENT OF AGRICULTURE COOPERATING

P. H. Ross, Acting Director Agricultural Extension Service

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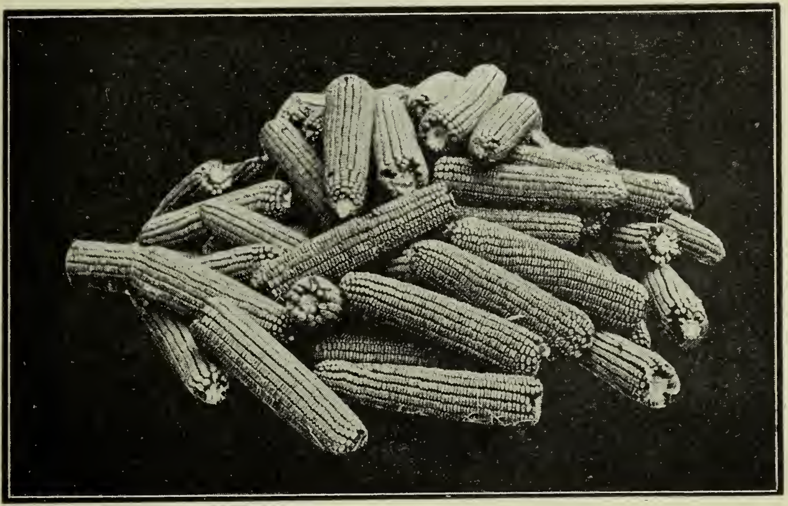
CIRCULAR 98 COLUMBIA, MISSOURI JANUARY, 1921

Organization of Corn Clubs

and

Corn Club Record Book

R. H. Emberson — Roy T. Kirkpatrick



Name ....

Postoffice ...., County ....

Age .... R. F. D., ...

Name of Local Leader ....

Name of County Leader ....

PLAN OF CORN GROWING CLUBS

Object

The object of corn club work is to encourage the following practices:

1. Seed selection and seed testing.
2. Proper methods of seed bed preparation, corn cultivation, and harvesting.
3. Keeping accurate records of all operations, and the cost, yield, and profit secured.
4. Judging and exhibiting seed corn.
5. Raising pure bred seed corn for sale.

Besides these direct objects of the club, it will also assist members in learning more about the common types and varieties of corn, about conducting public meetings, and about the value of more efficient methods in crop production.

Organization

For efficient work corn clubs must be properly organized and conducted. The following are essential:

1. A county leader to supervise the work.
2. A local leader for each local club.
3. Club members from ten to eighteen years of age.
4. Club officers—president, vice-president, secretary-elected from club menbers.

The organization of the club with the club officers is very important. It is necessary that meetings be held at various times during the season, at which meetings the problems of the work will be discussed and plans adopted. It is impossible to conduct real effective meetings without proper leadership. It is believed that these meetings will prove to b one of the most interesting and profitable parts of the club work.

Method of Procedure

1. Clubs may be organized any time between January 1 and May 1. All must be organized by the first of May, and it is much better to have the organization completed much earlier than this if the best results are desired.

2. Club members must secure the consent of their parents or guardians to do the work.
3. Club members must agree to study carefully all topics of instruction, attend club meetings, take part in the local or county exhibit, if one is held, and to write a story of the work containing from three hundred to five hundred words.
4. Each member shall grow at least one acre of corn in one continuous tract. This plot may be a part of a larger field.
5. The plot should be rectangular in shape, and the width should be at least one-fourth the length.
6. The labor on the plot must be done by the contestant, who must keep accurate records of all items of the cost of production.
7. The Agricultural Extension Service, College of Agriculture, Columbia, Missouri, will furnish all topics of instruction for the work. These should be followed as nearly as possible.

A Standard Club

There are certain contests conducted and certain prizes offered each year for which only members of standard clubs are eligible. In order to be recognized as "standard" a club must have the following:

1. A membership of at least five members working on the same project.
2. A local club leader in charge of the work.
3. A club organization—president, vice-president, and secretary.
4. A definite club program. Certain meetings must be held throughout the season and records of these meetings kept by the secretary. This program of work should contain a local exhibit and an achievement day at the close of the season.

Basis of Award

In determining the final standing of a corn club member in any contest, or for any prize, the following scale will be used:

Yield	65%
Cost of production	20%
Story of work	15%

Club Meetings

Corn clubs should plan to hold six regular meetings. At the first meeting the aim of the club and its organization should be considered. It would be well at this time to decide upon the date and place of the other meetings in order that all members may be thinking and planning for them.

At the second meeting the securing and testing of seed corn and the selection and fertilization of the corn plot might be discussed. Make a study at this time of the various varieties of corn commonly grown in the community, find what varieties are to be grown at the home of each of the members, and then decide upon the variety or varieties to be used by club members on their plots.

Any difficulties that have arisen should be considered at the third meeting. Discuss the percent of stand secured on the various plots. Consideration should be given to the keeping of records unless this has been done at a previous meeting.

At the fourth meeting there may be considered the methods of cultivation and the combatting of insect pests; and at the fifth meeting the selection of seed corn, selecting and arranging corn samples for exhibition, the time and place for the local exhibit, and the making of final reports.

The sixth meeting might well be held at the time of the local exhibit. At this time the final reports should be made out and sent to the central office. Now, too, consideration should be given to the following year's club. It is strongly urged that at least five acres of corn be grown the second year. This should be discussed by the membership, the advantages and any supposed disadvantages pointed out, and some decision reached, if possible.

The time and place of holding the exhibit, the names of the first, second and third winners, and a story of their work, should be sent to the central office by the first of November.

At each meeting the president of the club should preside and the secretary should keep the records. Club members should learn to conduct public meetings. The meetings would be more enjoyable if they were enlivened with some club songs and club yells, repeating club mottoes, and with some games. Copies of club songs and further suggestions for conducting meetings will be sent to all club leaders.

Meetings may very well be held at the homes of club members. This gives an opportunity to see a club plot and to make it the basis for discussion.

There are decided advantages in working as an organization and in holding regular meetings. Begin with the determination to carry out the club program, and you will surely be pleased with the result.

The Local Exhibit

The local exhibit should close the club work for the year. It should be held at some place where it can be made the greatest success; the schoolhouse, a church, a store, a bank, or a home.

The exhibit should consist of ten-ear samples and of single-ear samples, germination tests of corn grown, reports of work, stories of the work, stories of the club organization, and pictures relating to the work.

Along with the local exhibit should be held a demonstration on seed selection, seed testing, seed judging, and on the corn plant and the use or function of the various plant parts. The demonstration team should consist of three members and should be selected from the club membership at the fourth or fifth meeting. This demonstration team should later represent the club in county, district and state contests.

Awards may be made without any ribbons or premiums. However, a few ribbons and premiums will add much to the interest of the occasion.

Appropriate talks for this meeting would be "The Significance of Club Work to a Community," and "The Corn Crop as a Commercial Factor." Some of the stories on club work might be read by some of the members.

The exhibit should be advertised through the schools and the local press, and the county papers furnished with a report of the exhibit, including names of exhibitors, names of winners, varieties of corn on display, the work of the demonstration team, and any other interesting feature connected with the event.

Lastly, let each club organize at once for another year, with the aim in view of trying to beat last year's records.

Conclusion

Above all, be sure to study instructions carefully, follow them as nearly as possible in your work, complete your work, make out your final report and see that it and your story reach the office of the county leader or the State office, Boys' and Girls' Club Work, Agricultural Extension Service, Columbia, Missouri.

RECORD OF THE CORN PLOT

Fill out the following record as far as possible. It will furnish facts for the story of your work.

1. Kind of soil (clay, loam, clay loam or sandy)..............
2. Bottom or upland ....
3. Depth of topsoil ....
4. Kind of subsoil (clay, sandy, gravel or rocky) ....
5. Depth of plowing ....
6. What was done to land before breaking? ....
7. Kind and amount of fertilizer used this year, if any ....
....
8. When and how was fertilizer applied? ....
9. Variety of corn grown............ Was seed pure? ....
10. Source of seed corn ....
11. Was seed tested? ....
12. Date planted...............Depth planted...............
13. Method of planting (checked or drilled) ....
14. Distance between rows ....
15. Distance between hills or stalks in the row...............
16. Stand of corn (good, medium or poor)..................
17. Was corn harrowed after planting? ....
18. Number of cultivations ....
    First date..........Implement..........Depth..........
    Second date.......Implement..........Depth..........
    Third date.........Implement..........Depth..........
    Fourth date.......Implement..........Depth..........
19. Was corn damaged by disease, insects or storms? ....
20. Extent of damage ....
21. What treatment did you give for insects or disease? ....
....
22. Was the treatment successful? ....
23. How much seed was selected, if any? ....
24. How and when was seed selected? ....

LABOR RECORD

Instructions: Fill out the record on opposite page as the work is done. It is not necessary to keep each day separate; it may be more convenient to group the time spent in one operation, as for example you may plow two days of ten hours each and would enter it: "April 2 to 4—20 man hours, 40 horse hours."

Man hour is the labor of one man for one hour, and horse hour is one horse working for one hour, two horses working for thirty minutes, or three horses working for twenty minutes. The value of a man hour and a horse hour will be furnished you before harvesting time.

LABOR RECORD

Date	Plowing and Preparing Seed Bed		Planting and Replanting		Harrowing and Cultivating		Harvesting and Miscellaneous Labor	
	Man Hours	Horse Hours	Man Hours	Horse Hours	Man Hours	Horse Hours	Man Hours	Horse Hours
Total Hours								
Cost								
Total Cost								

SUMMARY ONE ACRE CORN PLOT

Area field on which records were kept.....................Acres

Date planted.......Date harvested.......Days to mature.......

Percentage stand.........Percentage ear-bearing stalks.........

Weight of field gathered corn...................................lbs.

Weight of dry corn produced...........Shelling %...........

Dry shelled corn per acre, lbs..............Bushels..............

COST OF PRODUCTION

	Dollars	Cents
Breaking and working down Seed Bed	......	....
Value of seed used	......	....
Planting and replanting	......	....
Harrowing and Cultivating	......	....
Harvesting	......	....
Miscellaneous Labor	......	....
Total Cost...........Acres......................	......	....
Cost per Acre	......	....
Value per acre of corn produced (.........per bu.)..	......	....
Net Profit	......	....
Cost of production per bushel	......	....
Net Profit per bushel	......	....

....................................Club Member

....................................Club Leader

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
COOPERATIVE EXTENSION WORK IN
AGRICULTURE AND HOME ECONOMICS
UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE AND THE UNITED STATES
DEPARTMENT OF AGRICULTURE COOPERATING
P. H. Ross, Acting Director, Agricultural Extension Service
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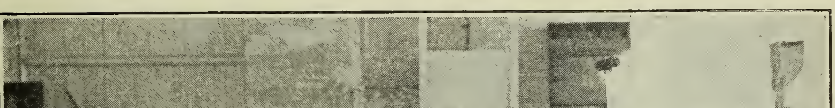
Condensed Information on Sprays and Spraying

H. A. Cardinell



Fruit growers and horticultural workers are often in need of a handbook of ready reference. With that idea in mind this circular has been prepared.

The information found in this circular should be of use to amateur growers and gardeners and of handy reference interest to commercial growers.

AMOUNT OF SPRAY SOLUTION ACCORDING TO TREE AGE

Unless he knows definitely how much spray solution is required by fruit trees of different ages, the fruit grower is at a loss to know how much to buy. The following table, while not infallible because trees of the same age vary greatly in size, will be of aid in determining how much material to buy, and will give growers an idea whether they are applying too much or too little to the trees. Trees of normal size should receive approximately the following amounts of diluted spray solution for thorough spraying.

TABLE I.—VOLUME OF SPRAY FOR TREES OF VARIOUS AGES.

AGE OF TREE	PEACH TREES	PLUM TREES	APPLE TREES	PEAR TREES
1 to 3 yrs.	¼ to 1 gal.	¼ to 1 gal.	....	....
3 to 5 yrs.	1 to 2 gals.	1 to 1½ gals.	¼ to 2 gals.	¼ to 1 gal.
5 to 6 yrs.	2 to 2½ gals.	1 to 1½ gals.	2 to 3 gals.	1 to 1½ gals.
6 to 8 yrs.	2½ to 4 gals.	2 to 3 gals.	2½ to 4 gals.	2 to 3 gals.
8 to 12 yrs.	3½ to 5 gals.	2½ to 5 gals.	3 to 5 gals.	3 to 4 gals.
12 to 18 yrs.	3½ to 5 gals.	4 to 5 gals.	4½ to 6½ gals.	4 to 6 gals.
18 to 25 yrs.	3½ to 5 gals.	4 to 5 gals.	6½ to 10 gals.	6 to 8 gals.
More than 25 yrs.	....	....	10 to 12 gals.	8 to 10 gals.

HOW TO ESTIMATE AMOUNT OF MATERIALS TO BUY

Winter Spray.—In order to estimate lime-sulphur needed, multiply the total number of trees about the same age by the quantity per tree estimated in the above table, and multiply by the number of applications to be applied, then divide this total by 450 if you intend to use a dilution of 1 to 8. This will give the number of 50-gallon barrels of concentrated material you should purchase. A 50-gallon barrel of lime-sulphur solution diluted 1 to 7 makes 400 gallons of spray; diluted 1 to 8 makes 450 gallons; and 1 to 9 makes 500 gallons.

Summer Spray.—A 50-gallon barrel of lime-sulphur solution, diluted 1½ to 50 will make 1700 gallons of spray. Calculating in the above manner and dividing by 1700 will give the number of barrels to be purchased.

Arsenate of Lead.—In estimating arsenate of lead multiply the number of trees of the same age by the quantity indicated in the foregoing estimates for that age of tree; multiply by the number of applications to be used, then divide this total by 50, which will give the number of 50-gallon batches required to spray them; next multiply this by 1 or 2 or 2½ depending on whether you are using 1, 2 or 2½ pounds of powdered or paste form to 50 gallons of water. This will give you the number of pounds to order.

TABLE II.—SPRAY DILUTION TABLE

Spray material	Total gallons of diluted spray in tank, barrel or bucket.						
	200	150	100	50	10	5	1
(A) SUMMER. Spray material and usual rate of dilution for trees in foliage.	Amount of spray material to add to each quantity above.						
Arsenate of lead powder, 1 lb.-50 gals.	4 lbs.	3 lbs.	2 lbs.	1 lb.	3¼ oz.	1½ oz.	3 teaspoonfuls
Arsenate of lead paste, 2lb-50 gals.	8 lbs.	6 lbs.	4 lbs.	2 lbs.	6¼ oz.	3¼ oz.	1 teaspoonful
Calcium arsenate powder, ¾lb-50 gals.	3 lbs.	2¼ lbs.	1½ lbs.	12 oz.	2¼ oz.	1¼ oz.	2 teaspoonfuls
Paris green 6 oz. to 50 gals.	1½ lbs.	1¼ lbs.	12 oz.	6 oz.	1¼ oz.	½ oz.	½ teaspoonful
Nicotine sulphate (40%) ½pt. to 50 gal. (1-800).	1 qt.	1½ pt.	1 pt.	8 fl. oz.	1½ fl. oz.	¾ fl. oz.	1 teaspoonful
Liquid lime-sulphur 1½ gal to 50 gal.	6 gal.	4 ½ gal.	3 gal.	1½ gal.	1¼ qt.	½ qt.	4 fl. oz. or 8 tablespoonfuls
Bordeaux mixture 4-4-50 formula*	16 lbs.	12 lbs.	8 lbs.	4 lbs.	⅘ lb.	⅕ lb.	5 tablespoonfuls
Self-boiled lime sulphur mixture 8-8-50*	32 lbs.	24 lbs.	16 lbs.	8 lbs.	1¾ lbs.	¾ lbs.	See spray calendar for stone fruits
(B) WINTER. Spray material and usual rate of dilution for dormant trees. Lime-sulphur liquid concentrate 33° (rate 1 gal. to 8 gal. water).	25 gal.	18¾ gal.	12½ gal.	6¼ gal.	1¼ gal.	2½ qt.	1 pint

*These amounts mean the number of pounds of each material, copper sulphate and lime; that is 16 pounds of copper sulphate and 16 pounds of lime for 200 gallons, etc. The same is true for self-boiled lime-sulphur.

APPLES, PEARS AND QUINCES

Table III.—When to Spray Apples, Pears and Quinces, What to Use and What it Controls.

What to Spray for	When to Spray	What to Use
SPECIAL CONDITION SPRAY San Jose Scale, etc.	Anytime after leaves drop in the fall and before growth starts in the spring. Most effective just before the buds swell.	Commercial liquid lime-sulphur (1 to 8). May be omitted if scale is not present. If dry lime-sulphur is used follow directions on the package.
1. Plant lice (aphids) Apple Scab Curculio Apple Rust Canker worm	When cluster buds are separated but before blossoms open.	Liquid lime-sulphur (1½ to 50) plus 2 lbs. of arsenate of lead paste or 1 lb. of powdered form. For aphids add ½ pt. nicotine sulphate to the 50 gal. mixture.
2. Plant lice Codling Moth Spring Canker Worm Apple Scab Curculio Lesser Apple Worm	Start when bloom is two-thirds off and finish before blossom ends close. Most important spray and should never be omitted.	Liquid lime-sulphur (1½ to 50) plus 2-3 lbs. arsenate of lead paste or 1-2 lb. of the dry form. If plant lice are present add ½ pt. nicotine sulphate to the 50 gal. mixture.
SPECIAL CONDITION SPRAY Curculio Apple Blotch	If Curculio injury or Blotch is severe apply not earlier than 6 nor later than 12 days after petals fall.	Bordeaux mixture* (3-4-50) (This means 3 lbs. copper sulphate; 4 lbs. stone lime and 50 gal. water;) plus 1¼ lbs. powdered arsenate of lead (or 2½ lbs. of paste form).
3. Apple Blotch Curculio Codling Moth Lesser Apple Worm Leaf Eating Insects.	Apply within three to four weeks after bloom falls.	Bordeaux mixture* (3-4-50) plus 1 lb. of powdered arsenate of lead or 2 lbs. of the paste form.
4. Apple Blotch Curculio Codling Moth Lesser Apple Worm Leaf Eating Insects	Apply 6 weeks after the bloom falls, or if Special Condition Spray has been put on 6-10 days following No. 2, make No. 4 3 to 4 weeks later.	Bordeaux mixture* (4-4-50) plus 1 lb. of arsenate of lead powder or two lbs. of the paste form.
5. Apple Blotch Lesser Apple Worm Codling Moth Curculio Sooty Blotch, Etc. Bitter Rot Leaf Eating Insects	Apply about 3 or 4 weeks after No. 4 or 8-10 weeks after bloom falls.	Bordeaux mixture* (4-4-50) plus 1 lb. of arsenate of lead powder, or 2 lbs. of paste form.

*If orchard is not troubled with blotch or Bitter rot, use lime-sulphur solution 1½-50 instead of bordeaux in Nos. 3, 4 and 5.

Caution.—All the above sprays are not likely to be needed. A study of the insects and diseases common to your orchard will help to arrange a schedule adapted to the needs of your orchard. The sprays ordinarily needed are 1, 2, 3 and 5 in the northern half of Missouri while in the southern half it is advisable to apply five or more sprays.

Important.—In localities where Bitter rot needs attention, later spraying at intervals of two to three weeks may be necessary.

To prepare bordeaux mixture.—Dissolve 4 pounds of copper sulphate (blue stone) in water; slake 4 pounds of unslaked lime in water, adding the water very slowly until steaming uniformly. After steaming has ceased, add water to make a creamy solution. The two solutions should be poured at the same time into the spray tank.

Stock solutions may be prepared for the season's use by dissolving copper sulphate at the rate of 1 pound to each gallon of water in the container. Then use as many gallons of stock solution as there are pounds in the formula. Never use metal containers for bordeaux mixture.

PEACHES

TABLE IV.—WHEN TO SPRAY PEACHES, WHAT TO USE AND WHAT IT CONTROLS.

No.	What to Spray for	When to Spray	What to Use
1.	Brown Rot Peach leaf curl San Jose scale	Just before buds burst.	Liquid lime-sulphur 1 gal. to 8 gal. of water.
2.	Curculio Peach scab Leaf eating insects Brown rot	As soon as most of the shucks are off the fruit, about 10 days after petals drop.	1½ lbs. arsenate of lead powder (or 3 lbs. of paste form) in self-boiled lime-sulphur. (Do not use commercial liquid lime-sulphur.)
3.	Curculio Brown rot Peach scab Leaf eating insects	Apply 6 to 10 days after shucks are off. If curculio is not serious apply 2 wks. after shucks have fallen.	Self-boiled lime-sulphur 8-8-50 plus 1½ lbs. powdered arsenate of lead (or 3 lbs. of the paste).
4.	Curculio Brown rot Peach scab Leaf eating insects	Apply 2 to 3 weeks after No. 3 (or at least 3 weeks before fruit ripens).	Self-boiled lime-sulphur as in No. 3.

Spray No. 1, if applied just as buds are beginning to open, will control Brown rot; also dry-lime sulphur or bordeaux 4-5-50 is effective.

During normal seasons Nos. 2 and 3 will afford sufficient protection, but during wet seasons Elberta and other late varieties may need later applications of self-boiled lime-sulphur. Never spray peaches, however, later than three weeks before picking. For very early varieties Nos. 1 and 2 will be sufficient. For late varieties never omit No. 3.

Preparation of Self-boiled lime-sulphur.—Good stone lime (not air slaked) 8 lbs., flowers of sulphur (finely ground) 8 lbs., water, 50 gallons. Place lime in a barrel or vat and add enough water to start slaking. When plenty of heat is being generated, gradually add finely ground sulphur while stirring the lime to prevent caking. Add water when needed to keep the mixture from drying or burning. When slaking ceases, add water to make up to 50 gallons. Strain into barrel or tank.

Brown rot.—This is very severe on peaches in Missouri and can be readily detected by the sunken-brown spots on the fruit, often causing fruit to crack after a rain. The peaches usually dry up and hang on the trees over winter. If you have had these "mummies" on your trees in previous years, be sure to apply Nos. 2 and 3.

PLUMS AND PRUNES

TABLE V.—WHEN TO SPRAY PLUMS AND PRUNES, WHAT TO USE, AND WHAT IT CONTROLS.

No.	What to Spray for	When to Spray	What to Use
1.	Brown rot San Jose Scale Black knot Plant lice	Just before buds burst.	Liquid lime-sulphur 1 gal to 8 gal. of water.
2.	Curculio Leaf eating insects Leaf spot Brown rot	As soon as most of the blossoms are off.	1½ lb. arsenate of lead powder (or 3 lbs. of paste form) in self-boiled lime-sulphur (see directions below spray calendar for peaches).
3.	Curculio Brown rot Leaf eating insects	Apply 15 days after blossoms are off, or when fruit is size of small green peas.	Self-boiled lime-sulphur 8-8-50 plus 1½ lbs. powdered arsenate of lead (or 3 lbs. of the paste).
4.	Brown rot Leaf eating insects	Apply 2 to 3 weeks after No. 3 (or at least 3 weeks before fruit ripens).	Self-boiled lime-sulphur as in No. 3 (omit arsenate of lead).

During normal seasons Nos. 2 and 3 will afford sufficient protection, but during wet seasons late varieties may need later applications of self-boiled lime-sulphur, but never spray plums later than three weeks before picking.

For making self-boiled lime-sulphur, and also for a discussion of Brown rot see notes following Table IV.

Plant Lice.—If plant lice (aphids) are noticed, apply a separate spray of ¾ pint of nicotine sulphate, 2 pounds of soap, if water is soft, or 4 pounds if water is hard, and add water to make 50 gallons. Spray before the leaves curl, to hit the insect.

CHERRIES

TABLE VI.—WHEN TO SPRAY CHERRIES, WHAT TO USE, AND WHAT IT CONTROLS.

No.	What to Spray for	When to Spray	What to Use
1.	Scale	Just before the buds swell.	Liquid lime-sulphur 1 to 8 gals. of water. (Use only when scale is found.)
2.	Brown rot Curculio Leaf spot	After leaves have started to appear but before blossoms open.	Bordeaux mixture 2-3-50 or self-boiled lime-sulphur 8-8-50, plus one lb. arsenate of lead powder.
3.	Brown rot Curculio Leaf spot	Just after blossoms fall.	Bordeaux 2-3-50 or self-boiled lime-sulphur 8-8-50.
4.	Brown rot Curculio Leaf spot	When fruit is the size of a small pea.	Bordeaux 2-3-50 or self-boiled lime-sulphur 8-8-50.

Usually Nos. 2 and 3 will afford good protection to the fruit unless the season is late or rainy.

The bordeaux formula of Table VI is prepared by dissolving 2 pounds of copper sulphate (blue stone) in a wooden or earthen container and slaking 3 pounds of lime; diluting and pouring both solutions into the tank at the same time and stirring well while pouring. See directions following Table III.

GRAPES

TABLE VII.—WHEN TO SPRAY GRAPES, WHAT TO USE AND WHAT IT CONTROLS.

No.	What to Spray for	When to Spray	What to Use
1.	Anthracnose Black rot Downy mildew Insects (chewing) Aphids	When second or third leaf shows.	Bordeaux 4-5-50 plus 2 lbs. powdered arsenate of lead or 4 lbs. of paste form. Spray both sides of leaves and canes. Very important.
2.	Same as above	Before blossoms open	Same as above. (When plant lice are found add ¼ pt. nicotine sulphate to each 50 gallons.
3.	Same as above	After fruit sets.	Same as above. Very important.
4.	Same as above	10 to 14 days after No. 3.	Same as above.

Bordeaux Mixture for **grapes** is made in accordance with directions following Table III.

Grape sprays should be put on at the rate of 80 to 100 gallons per acre.

When fruit begins to form, spray directly on the berries, using a fine nozzle.

Black Rot.—This is the most serious enemy of the grape in Missouri and affects both leaves and fruit. On leaves it causes dark spots that are larger on the lower side. On the fruit it begins with small spots that spread until entire fruit is covered and causes fruit to dry and hang on the vine all winter. If possible plow under all leaves and dried fruit in early spring or rake and burn such trash.

Plant lice on grapes.—When plant lice (aphids) are noticed on underside of leaves add ½ pt. of nicotine sulphate to each 50 gallons of spray mixture.

CURRANTS AND GOOSEBERRIES

It has not been found practical to spray currants and gooseberries for leaf spot. If the imported currant worm appears, spray or dust with paris green and lime. (Use hellebore or pyrethrum; 1 ounce to 2 gallons of water after fruit is half grown.)

If mildew, a grayish, powdery fungus, appears apply potassium sulphide (liver of sulphur) at the rate of 1 ounce to 2 or 3 gallons of water. If plant lice (aphids) appear use nicotine sulphate before they curl the leaves; as discussed following Table VIII. Plowing under dead leaves or burning them will aid greatly in the control of leaf spot.

RASPBERRIES AND BLACKBERRIES

Most of the diseases of raspberries and blackberries can not be satisfactorily controlled by spraying.

Plant only those varieties which are more resistant to disease, such as Kansas black raspberry, etc., for Missouri conditions. Cut out and burn all old canes as soon as the fruit is off.

If caterpillars appear on leaves after plants are in foliage, spray with arsenate of lead at the rate of 1 pound of the powdered form to 50 gallons of water.

STRAWBERRIES

Commercial strawberry growers do not usually consider it practical to spray strawberries for diseases.

It is better to plant varieties that are more resistant such as Aroma and Gandy, under Missouri conditions, and then mow the plants and burn over the field on a windy day after the fruit is harvested.

If spraying is desired, use bordeaux mixture 4-4-50, following Table III; and, if the leaf roller is present, spray with arsenate of lead.

MELONS, SQUASHES AND CUCUMBERS

TABLE VIII.—WHEN TO SPRAY MELONS, SQUASHES AND CUCUMBERS, WHAT TO USE, AND WHAT IT CONTROLS.

No.	What to Spray for	When to Spray	What to Use
1.	Beetles (yellow and black striped or spotted beetle) that eat the plants. (Often called "Melon Bug" in Missouri.)	When young plants come through the ground. Repeat each week until plants begin to vine.	Use a hand duster and apply arsenate of lead powder, paris green and air-slaked or hydrated lime using ¼ arsenate of lead powder, ¼ paris green and ½ lime dust. Repeat every week until vines form.
2.	Anthracnose Beetles Plant lice	When the vines begin to run.	Bordeaux mixture 4-4-50 plus 1½ lbs. of arsenate of lead powder. If plant lice appear add ¾ pint of nicotine sulphate to the 50 gal. mixture.
3.	Anthracnose Beetles Plant lice	One week after the first melons have "set" on the vines.	Same as No. 2.
4.	Anthracnose Beetles	Two or three wks. after No. 3.	Bordeaux mixture 4-4-50 plus 1½ lbs. of arsenate of lead powder.

If plant lice (aphids) become troublesome apply a separate spray of ¾ pint of nicotine sulphate to 50 gallons of water and add 3 pounds of cheap laundry soap dissolved in boiling water. This spray must be applied thoroughly as soon as aphids appear and before leaves are curled.

Bordeaux preparation used here, same as following Table III.

If desired prepared bordeaux, or bordeaux-arsenate of lead may be purchased, although the cost is more than that of the home-made product.

ARSENATE OF LEAD POWDER

The powdered form of arsenate of lead varies in its fluffiness and specific gravity. The heavier forms will require 3 to 5 tablespoonfuls to weigh an ounce, while lighter forms will require 6½ to 9½ tablespoonfuls to weigh an ounce.

DRY ARSENATE OF LEAD DUSTING

One part of arsenate of lead powder is mixed with three parts of dry lime or road dust.

These materials are mixed together and dusted on the plants with any type of sifter. If the vegetables are planted in straight rows, a stick can be used with a small cheesecloth sack containing the dusting material tied on each end of it. These sacks can be slid along the stick to fit the distance between the rows, and jarring will cause the dust to fall upon the plants. Apply the dust after a rain or early in the morning when the plants are wet with dew.

DUSTING WITH PARIS GREEN

Paris green	1¾ tablespoonfuls
Air-slaked lime, road dust or flour	1 qt. measure

PARIS GREEN LIQUID SPRAY

Paris green	2½ teaspoonfuls
Lump of unslaked stone lime, ground or crushed	3 tablespoonfuls
Water	7 qts. or 1¾ gal.

For potatoes.—

Paris green	1½ teaspoonfuls
Use lump lime, ground or crushed	3 tablespoonfuls
Arsenate of lead powder	3 teaspoonfuls
Water	3 quarts

PYRETHRUM OR INSECT POWDER LIQUID SPRAY

Pyrethrum powder	4 tablespoonfuls
Water	1 gallon

PYRETHRUM DUSTING

Pyrethrum	1 part
Road dust or air-slaked lime	1 part

Use only pyrethrum on cabbage or cauliflower after head forms.

COMBINATION SPRAYS

The various spray solutions which may or may not be combined are indicated below.

	Bordeaux mixture	Lime-sulphur	Nicotine sulphate
Bordeaux Mixture		no	yes
Lime-sulphur	no		yes
Arsenate of lead	yes	yes	yes
Arsenate of calcium	yes	yes	yes
Paris green	yes	no	yes

POTASSIUM SULPHIDE

Potassium sulphide	1 ounce
Water	3 gallons

(Used against mildew on gooseberries, roses, etc.)

DRY LIME-SULPHUR

Dry lime-sulphur, to date, varies according to the brand and does not seem to be so well standardized for a uniform test suitable to all brands. Because of the lack of a standard test suitable to all brands of dry lime-sulphur as worked out for lime-sulphur solution, it is impossible at this time to include dry lime-sulphur recommendations in the brief spray calendars.

When dry lime-sulphur is used follow carefully the directions on each package.

MISCIBLE OILS

There are many brands of "miscible" or "soluble" oils on the market which should be better known by Missouri fruit growers. The oils have a greater spreading property than have lime-sulphur sprays, and therefore, oil sprays have high killing powers. These oils not only destroy scale insects but the eggs of many insects. Miscible oil is usually a little more costly than lime-sulphur but it does not have the disagreeable burning of hands and face as when lime-sulphur is used. Therefore, the spraymen will usually do a more thorough job than when facing lime-sulphur at winter strength. Naturally oil sprays cannot be used when the leaves are on the trees.

Miscible oil should be well stirred before using and the spray tank must be washed free of any alkalies and acids that might have remained from former spraying and never try to mix it with hard water. Pour the oil in the tank and add the water last to the oil. Best results will be had by applying early in the spring while trees are dormant and when the days are rather warm and sunny. Follow the directions on each package.

HYDRATED LIME FOR LIME-SULPHUR MIXTURE, ETC.

During the past season fruit growers of Missouri have found difficulty in obtaining fresh unslaked lime from their local distributors, unless they had placed orders in advance, and were forced to use hydrated lime in preparing bordeaux or lime-sulphur mixtures.

Fresh unslaked lime should be demanded wherever it can be obtained when intended for the preparation of lime-sulphur, self-boiled lime sulphur, or bordeaux mixture, as the results are far more satisfactory. However, the farm orchardist and gardener will often be forced to use hydrated lime, therefore the following instructions should be observed where hydrated lime is used. For bordeaux, use one-half more hydrated lime than is recommended for fresh lime.

For spraying peaches, plums and cherries use self-boiled lime-sulphur made from fresh unslaked lime; but if unslaked lime can not be secured or the lime is of a very inferior grade, fresh hydrated lime may be used.

HYDRATED LIME-SULPHUR

Formula.—8 lbs. of sulphur (fine flour or flowers, but preferably superfine sulphur); 8 lbs. hydrated lime. Dilute with water to make up 50 gallons.

Accurately weigh the proper amounts of sulphur and hydrated lime. Put each material through a fine sieve. Mix the two materials thoroughly in dry form before adding the water. Never use old hydrated lime but order fresh supplies and open only as needed.

When adding arsenate of lead to the hydrated lime-sulphur make it into a thin solution before adding it to the diluted mixture.

LIME-SULPHUR

A large number of Missouri growers use their threshing or stationary engine to make their own lime-sulphur during winter months. Very few of the growers, making their own lime-sulphur, test it with a hydrometer. There is always a wide range in density between various lots made and it is very important that each barrel or at least each batch be tested with the hydrometer and the barrels marked according to test.

All standard commercial brands of lime-sulphur are marked as to the density test, but if the label is lost every fruit grower should be able to test that barrel. No spray calendar can be followed unless you know the hydrometer test of each barrel.

TABLE IX.—DILUTION FOR DORMANT AND SUMMER SPRAYING WITH CONCENTRATED LIME-SULPHUR SOLUTION.

Density of solution by Baumé hydrometer readings; in degrees.	Add one gallon of concentrated lime-sulphur solution to the number of gallons of water given below depending on test in left-hand column.	
Degrees—Baumé	Dormant Spray	Summer spray for foliage
15	2¼ gallons	14 gallons
16	2½ gallons	15 gallons
17	2¾ gallons	16 gallons
18	3 gallons	17 gallons
19	3¼ gallons	18½ gallons
20	3½ gallons	19¾ gallons
21	3¾ gallons	21¼ gallons
22	4¼ gallons	22¾ gallons
23	4½ gallons	23¼ gallons
24	5 gallons	25¼ gallons
25	5¼ gallons	27¾ gallons
26	5¾ gallons	29½ gallons
27	6 gallons	31 gallons
28	6½ gallons	32¾ gallons
29	6¾ gallons	34½ gallons
30	7¼ gallons	36½ gallons
31	7½ gallons	37¾ gallons
32	8 gallons	40 gallons
33	8¼ gallons	41½ gallons
34	8¾ gallons	43¼ gallons
35	9 gallons	45 gallons

Lime-sulphur that has been frozen or allowed to evaporate if left over from year to year should be tested with a hydrometer, if used at all.

After testing, paint on each barrel the exact test and when spraying use the table below, so that your helpers cannot make a mistake.

SUGGESTIONS FOR BETTER SPRAYING

Many Missouri growers during past seasons have found that their method of spraying was not controlling the diseases and insects, especially in the localities where late rains were frequent. If rains are persistent, put on later applications; examine the top areas of your trees after they have been sprayed and see if the men are reaching the high trees. If you are not satisfied with the spraying being done by your men or do not know how thoroughly you are spraying the tops, add to your spray tank one-half pound of iron sulphate dissolved for each gallon of concentrated lime-sulphur used. For example; if you use 6 gallons of lime-sulphur solution to a 200-gallon tank for summer spraying, then add 3 pounds of dissolved iron sulphate to the tank. The black color of the mixture will allow you to see how thoroughly you are covering the tops. By treating one tank with this material each day you can check up on your men. Should you find that your sprayer will not force material to the upper limbs, put a tower on your outfit and also increase the pressure. Lack of sufficient pressure is usually the trouble. Many growers have purchased higher-powered engines and larger pumps to mount on old outfits. Large commercial growers using 3½ or 4 horse-power machines, who cannot get over the entire orchard without using two guns, would do well to write to the Agricultural Experiment Station or Agricultural Extension Service, Columbia, Missouri, for suggestions on the use and equipment of a higher-powered machine than is ordinarily used in this state.

Study your needs carefully and if it is speed coupled with more effective control that you desire, get a high-powered outfit. If you cannot spray your orchard in the few days allowed for each application, as stated on the spray calendar, don't try to reduce the work by using two guns on a low-powered machine. Use one gun or two rods and do a thorough job.

The main point at which Missouri growers are failing to control insects and diseases, is in the matter of the amount of solution applied per tree. The growers that apply the correct amount to each tree according to size, and do so consistently throughout the season always have the best control.

Growers would do well to study the tables on pages two and three and determine the amount their trees should require and keep record of the number of trees that a tank will cover and find out if the trees are getting their share of each tank.

At the end of the spray season, clean the sprayer thoroughly so it will be ready to run the next season.

The following formula has been recommended for this purpose. Place 25 gallons of water in the spray tank and add one pound of concentrated lye, one gallon of cylinder or old crank case oil; run the pump at high pressure and with coarse nozzles or a spray gun thoroughly wash off all surplus grease and dirt.

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Feeding and Care of the Brood Sow and Litter

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Profit is determined by the number of pigs raised rather than the number farrowed.

The successful feeding and management of the brood sow just before, during and just after farrowing probably calls for more skill than the care of the swine herd at any other time of the year. Overfeeding or underfeeding or the lack of proper attention to details at this particular time may destroy otherwise good chances for profit from the swine business.

The importance of prolificacy in brood sows should rightly be emphasized. The number of pigs farrowed, however, is not as important as the number raised. From the standpoint of profit per sow, other things being equal, it is obvious that the sow which farrows six pigs and raises all of them is more valuable than the sow which farrows ten pigs and raises only four.

BEFORE FARROWING

The disposition of the sow, her feed and care while pregnant and even before breeding all have much to do with the number of pigs she will raise. Proper feeding just before and immediately after farrowing and close attention to all details at this time, however, are also important factors in determining the percentage of pigs raised from the total number farrowed. It has been observed, for example, that a sow at one farrowing time may manifest a quiet, motherly disposition, while at another time the same sow may be decidedly lacking in these characteristics. The way in which she has been handled previous to farrowing time no doubt accounts, in part at least, for this difference.

With purebred gilts and sows, the breeding date is usually known so that the approximate time of farrowing is easily determined. Most gestation tables give the period of pregnancy of sows as 112 days. The period ordinarily will not vary more than from 108 to 118 days, depending upon age and condition of individual and various other factors, while 112 to 114 days will usually be the length of time from breeding until the sow farrows. Strict account should then be kept of breeding dates for a definite knowledge of the time a sow can be expected to farrow will help materially in making proper care possible.

QUIET QUARTERS

At least a week before the sow is due to farrow, she should be placed in the quarters where she is to farrow her litter. This is important for the number of pigs which a sow will save depends very largely upon her being quiet when she farrows. If she is not given a chance to become accustomed to her quarters before she is due to farrow, she may be very restless and discontented, constantly getting up and down and, as often happens when sows are placed in new quarters just before farrowing, she may break out and go back to the place she has been quartered to make her bed and farrow her litter. It is desirable, when selecting a place for the sow to farrow, to remove her from other sows if such an arrangement is practical, for if this is done the sow will be more quiet and contented.

BEDDING

The kind and amount of bedding provided also has considerable influence upon the results obtained at this time. The amount should be moderate, it being easier to make the mistake of supplying too much than not enough. The place in which the sow is to farrow should be warm enough that large quantities of bedding will not be needed for warmth. The best kind of bedding for use at this time is that which is fine and tends to pack closely rather than long, coarse material. When too much, or coarse bedding is used the pigs are apt to get down into it, become hidden from the sow and are often smothered or crushed. A bushel of wheat chaff, cut straw or shredded corn stover is good. For a day or two after the sow farrows the quantity of bedding should not be increased, but should be changed as often as is necessary in order to keep the bed dry. The important consideration is not MUCH bedding but DRY bedding.

Quiet quarters at farrowing time aid greatly in saving the pigs.

Usually the less the sow is disturbed when she is farrowing the better. It is important, however, that the herdsman should be on hand to render assistance if it is needed. If help is supplied, it should be given quietly and in such a way as to disturb the sow as little as possible. It is essential that the pigs do not become chilled before they have dried off and have suckled. If the weather is very cold and the sow is gentle, it may be advisable to take each pig away from its mother as soon as it is farrowed and to place it in a barrel or box containing a jug filled with hot water. Hot bricks covered with old sacks or straw also serve this purpose. The pigs may be left there until well dried off and lively enough to put with the sow. If the pigs should become chilled, there is no better way to revive them than to dip them in warm water. This will often revive them when all other means fail. If a sow farrows during severe weather, artificial heat may be needed for the farrowing pen. This may be supplied with a lantern hung overhead or by a small kerosene stove placed so it cannot be overturned or touched by the sow. An old blanket spread over the sow may help if she is quiet. If artificial heat is supplied, care should be taken not to get quarters too hot, since only a small amount of heat is normally necessary.

REMOVE NEEDLE TEETH

Newly born pigs have two small tusks called black or needle teeth on each side of both upper and lower jaw. These are very sharp and should be clipped off with a small pair of pliers or a tool made especially for this purpose. Care should be taken to cut teeth off smooth so that pig will not be able to cut other pigs about head when fighting for a place at the udder. Canker sore mouth, a very infectious disease, may start through injuries made by these small tusks. The removal of these tusks will help prevent sore mouths in the pigs and sore udders in the sows.

CORRECT FEEDING

Men differ somewhat in their opinions as to what constitutes proper feeding just before farrowing. All are agreed, however, regarding the importance of **careful** feeding at this time. Some advise feeding the sow the same kind of feed which she will receive after farrowing. When this is done, the digestive system of the animal becomes accustomed to the ration so that there is less danger of causing the pigs to scour than when the ration is changed abruptly. Others, however, seem to obtain better results by changing the feed of the sow to a more bulky ration as she approaches farrowing time. A sow may, for example, have been wintered on a ration of corn 8 parts, shorts 4 parts, bran 1 part, tankage 1 part, and as farrowing time draws near the proportion of bran may be increased until the sow gets nothing but bran just before and after farrowing. It is easier to avoid the common trouble of overfeeding if this is done, since the ration fed is very bulky and hence even though the sow eats considerable, she gets a relatively small amount of nutrients.

Regardless of some difference of opinion as to the exact feeds with which to make up the ration to be used at this time, there are certain well defined principles which should always be followed. The ration should contain plenty of protein, should be mildly laxative and the amount the sow receives should be reduced a few days before farrowing. If this is done the sow should approach farrowing time without becoming abnormally feverish and thus will not be nearly so restless nor apt to mash or eat her pigs. It is a good practice also to remove the afterbirth from pen as soon as the sow is through farrowing.

PIGS RESPOND TO CARE

There is no period in a pig's life when it will respond so readily to good or bad treatment as when it is suckling its dam. The skillful feeder, then, can expect a maximum return from his effort to properly feed and manage the young litter. On the other hand, the litter which receives improper feed and care before weaning, starts life with a handicap which is seldom overcome. The younger the pig, the more carefully its dam should be fed.

For best results the sow should not be fed anything for twenty-four hours after farrowing. Newly born pigs have capacity for very little food so the milk flow should not be stimulated for the first few days. Even under most favorable conditions, the sow at farrowing time will be in a more or less feverish condition, so should have all the water she will drink. If the weather is cold, it is advisable to take the chill off the water before giving it to the sow. The first feed given should be the same as she received just before she farrowed and should be small in amount and fed as a thin slop. The feed may be gradually increased as the pigs become able to take the milk, until the sow is getting all she will eat of a good, laxative, milk-producing feed. Ordinarily it will take about two weeks to get the sow on full feed, although the time will vary with different individuals. It is at this time, particularly, that good judgment is required of the feeder.

MILK-PRODUCING FEED

The requirements of such a ration are first, plenty of protein and mineral matter. Milk is high in these nutrients and, unless the sow is supplied them in her feed, maximum production cannot be expected. The ration should also be fairly bulky, that is it may contain more crude fiber than rations for very young pigs or fattening hogs. There are a number of combinations which might be expected to be equally satisfactory for feeding sows suckling pigs. The following have given good results and may be taken as examples of the kind which should be fed:

Rations for Sows Suckling Pigs.

Ration I		Ration II	
Corn	50 percent	Corn	8 parts
Shorts	25 percent	Shorts	4 parts
Bran	15 percent	Bran	1 part
Linseed oil meal	10 percent	Tankage	1 part

These feeds are proportioned by weight rather than measure. Hominy feed, ground barley or ground kafir may be substituted for all or part of the corn in the above rations. Likewise, ground oats may be substituted for part of the corn and shorts, and alfalfa hay or meal for the bran. If the sows are on good pasture the milk flow will be increased due to the beneficial effect of a succulent feed on milk production. When the pasture is alfalfa, clover or rape the amount of shorts, bran and tankage may be decreased somewhat from amounts called for in the foregoing rations.

ADDITIONAL FEED FOR PIGS

When the pigs are about a month old, they will be able to use more feed than that obtained from the sow even though the sow is properly fed and is a good milk producer. As soon, then, as the pigs will eat, they should be fed separately from their dam. A creep of some kind should be made for them, that is, they should have access to a small pen where the sow cannot go, to receive their supplementary feed. Skim milk fed in a shallow pan is very good for them. The pigs may be taught to run into the creep for feed by allowing them some shelled or ear corn. As soon as they begin to eat well, a slop made of milk, some shorts, a little bran and some linseed oil meal or tankage fed along with the corn will make a ration which with proper exercise should satisfactorily meet the requirements for rapid growth.

Good Ration for Young Pigs.

Corn	4 parts	by weight
Shorts	4 parts	
Bran	1 part	
Tankage	1 part	

As the pigs become older the corn in the above ration may be gradually increased until the amount has been doubled.

In addition to proper feed, the pigs should also have plenty of sunshine and exercise. These cost little to supply but are absolutely necessary for best results.

AILMENTS OF YOUNG PIGS

Perhaps the most common troubles, caused by lack of proper attention to the feeding and management of small pigs, are scours and thumps. Scours are usually caused by:

1. Changing the feed of the sow.
2. Overfeeding.
3. Dirty pens and troughs.
4. Exposure of either sow or pigs to cold rain or cold weather in such a way that they become chilled.

Since scours usually result from indigestion, the feeding at this time should be done with special care. Changing from sweet to sour milk often causes the trouble, as will also the feeding of too much high protein feeds such as tankage or linseed oil meal when the animal is not used to it. If the sow is overfed while the pigs are very young, her milk flow is so stimulated that the pigs will get more than they can utilize thus causing them to scour. Pigs should always be in dry, clean quarters and be fed in clean troughs. They should not be allowed to run out in cold rain or allowed to become chilled in any way. Sows running through filth and then being suckled by pigs, will often have pigs which will scour.

There are a good many remedies used to correct this trouble. The first thing to do is to cut down on the sow's feed, clean up her quarters, if not already clean, and give sow a physic, such as three or four ounces of epsom salts. If this is done, good results will usually follow. A tablespoon of sulphur in the sow's feed for two days is also good. Scalded milk is also a good remedy, or each pig may be given a good physic, such as a teaspoon of castor oil. A very successful breeder recommends a teaspoonful of carbolic acid in the sow's slop as a never failing remedy.

There is also a form of scours, which many believe to be contagious, called white scours. The treatment indicated is to thoroughly clean and disinfect pens and give a good physic.

Thumps in young pigs is the result of lack of sunshine and exercise along with too liberal feeding. The remedy is to cut down the sow's feed and force the pigs to take exercise out in the sunshine. Thumps also may occur in large pigs after they are weaned, but in older pigs it is usually due to lung or bronchial trouble, or to intestinal or lung worms.

SUMMARY

If the pig crop can be properly nourished and grown the first two or three months of its life without thumps, scours or similar troubles and changed from an animal dependent upon its mother's milk to one able to obtain its nourishment direct from feeding stuffs, much will have been done toward securing maximum development of the animal to be used for breeding or market purposes.

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